EVALUATION AND ANALYSIS OF IMPACT OF SUBSIDIES ON SMALL SCALE RENEWABLE ENERGY TECHNOLOGIES DISSEMINATION: A CASE STUDY OF NEPAL

Murdoch University

School of Engineering and Energy

Project report submitted in the partial fulfilment of the requirements for the completion of Master's Degree Dissertation

By:

Rojan Kumar Pandey
30901781

Under the supervision of

Dr. Trevor Pryor
Dr. August Schlaepfer

November 2011

Murdoch University

School of Engineering and Energy

November 2011

Student ----------

Rojan Kumar Pandey

Supervisors ---------- ----------

Dr. Trevor Pryor Dr. August Schlaepfer

Date: 21 November 2011

Declaration

This work is being submitted in partial fulfilment of the requirements for the degree of

Master of Science in Renewable Energy and has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

Statement

I, Rojan Kumar Pandey, declare that this dissertation is the result of my own work and investigations, except where otherwise stated. Other sources are acknowledged by giving explicit references. A bibliography is appended.

Signed.....

(Rojan Kumar Pandey)

Date.....

Abstract

The report has analysed the status of rural electrification using renewable energy technologies (RETs) and the current subsidy delivery modality of RETs in Nepal. As the Government of Nepal is subsidizing small scale renewable energy projects, it is important to evaluate and analyse the programme to make sure that a programme is running in an effective and efficient way while reaching the target group.

During the course of the research, primary information collected from the field has been compiled using appropriate tools/software (such as MS Office) and analyzed. Different sets of questionnaires were prepared, targeting different personnel ranging from the users' level to the government policy level. The field survey methods include field observations of RETs installations and operations along with interviews with selected users on a random sampling basis to identify barriers to subsidy delivery and possible measures to overcome these barriers; to determine user satisfaction level and time period for subsidy delivery mechanisms.

The report started with the country background information and the rationale behind the study. This is followed by the literature review and information on the current status of small scale RETs in the country. Next it deals with the organizational structure and current subsidy delivery modality of RETs in the country. The evaluation of the effectiveness of the subsidy with the current subsidy delivery modality has been analyzed based on six parameters; Targets and Achievements, Impact of RETs, Subsidy Delivery System Efficiency, Transparency, Sustainability and Effectiveness.

The research shows that the subsidized government program has been successful in achieving its goal to provide basic energy services in rural areas through RETs in terms of its quantitative target. Although the subsidized program is successful in electrifying the rural communities via RETs, the poorest of the poor families are still excluded from the subsidy. The program seems to benefit more the rich and upper middle class families rather than the poor families for which the subsidy was intended. The high capital cost and long subsidy delivery process are the main important reasons for this failure. The author has proposed a new modality which might overcome the time barriers and bureaucratic process in the subsidy delivery mechanism and will decrease the lead time. This will in turn help to reduce

the operational cost of the private companies and will encourage more players to enter the market, increase competition and result in lower system costs.

After identifying gaps in the current subsidy delivery modality, the project report ends with the recommendation of a new modality improving the current modality and filling the gaps identified. As this study has some limitations, as described in chapter one, the scope of further works has been listed at the end.

Table of Contents

Acknowledgement

I would like to express my sincere gratitude to Dr. Trevor Pryor, Academic Chair of Energy Studies, School of Engineering and Energy of Murdoch University for providing me an opportunity to do my project work on “"Evaluation and Analysis of Impact of Subsidies on Small Scale Renewable Energy Technologies Dissemination: A Case Study of Nepal” . I am greatly indebted to Dr. Pryor for his constant guidance and support as one of my supervisor of the project.

I sincerely thank to my main project supervisor Dr. August Schläpfer (adjunct faculty member of "Energy studies" programme of Murdoch University and now Director of Energy and Environmental Management in Developing Countries, University of Flensburg, Germany) for his guidance and encouragement in carrying out this project work.

I would like to thank Mr. Madhusudan Adhikari, Manager of Solar Energy Support Programme of Energy Sector Assistance Programme (ESAP) for his advice and suggestion in the project.

My special thanks to Mr. Niels Juhl Thomsen, Chief Advisor of ESAP for giving me permission to do the project works in ESAP by allowing me to use the available information and resources

I also wish to express my gratitude to the officials and all other staff members of Alternative Energy Promotion Centre and Energy Sector Assistance Programme. I would like to acknowledge all staffs of Regional Renewable Energy Service Centres (RRESCs) for helping me in field survey and data collection for the project. I wish to name Mr. Gokul Gautam, Mr. Satish Aryal, Mr. Rajeev Man Shrestha, Mr. Rajan Acharya, Mr Pradip Gyawali, Mr. Pawan Acharya in particular for their support and cooperation.

I would like to acknowledge specially my beloved family and my fiancée Sangita Bista for her support and encouragement throughout the project period.

Last but not least I wish to express my sincere gratitude to my sister Ms. Kusum Rajbhandari and family and my friends for their support and strength throughout the period.

Acronyms and Abbreviations

ADB	Asian Development Bank
AEPB	Alternative Energy Promotion Development Board
AEPC	Alternative Energy Promotion Centre
BESP	Biogas Energy Support Programme
BSP	Biogas Support Programme
CBO	Community Based Organisation
CBS	Central Bureau of Statistics
CEN	Clean Energy Network
CRE	Centre for Renewable Energy
CRT/N	Centre for Rural Technology, Nepal
CTEVT	Council for Technical Education & Vocational Training
DANIDA	Danish International Development Assistance
DDC	District Development Committee
DEEU	District Energy and Environment Unit
DEES	District Energy and Environment Section
DKK	Danish Kroner
ESAP	Energy Sector Assistance Programme
EU	European Commission
FYP	Five-Year Plan
GJ	Gigajoule
GoN	Government of Nepal
GPS	Geographical Positioning System
GTZ	German Technology Co-operation
HH	Household
kg	Kilogram
kW	kilowatt
ICIMOD	International Centre for Integrated Mountain Development
ICS	Improved Cooking Stove
INGO	International Non Governmental Organisation
IPP	Individual Power Producers
IUCN	International Union for Conservation of Nature
IWM	Improved Water Mill

KfW	Kreditanstalt für Wiederaufbau (Development Bank of Germany)
MGRE	Mini-Grid Rural Electrification
MGSP	Mini Grid Support Programme
MHP	Micro Hydro Power
MIS	Management Information System
MoLD	Ministry of Local Development
MoAC	Ministry of Agriculture and Cooperative
MoF	Ministry of Finance
MoE	Ministry of Environment
MoWR	Ministry of Water Resources
NEA	Nepal Electricity Authority
NGO	Non Governmental Organisation
NMHDA	Nepal Micro-Hydro Developers' Association
NOC	Nepal Oil Corporation
NPC	National Planning Commission
NPR	Nepalese Rupees
PV	Photovoltaic
RE	Rural-Renewable Energy
REDP	Rural Energy Development Programme
REF	Rural Energy Fund
RESC	Renewable Energy Service Contractors
RET	Rural Energy Technology
RETS	Renewable Energy Test Station
RRESC	Regional Renewable Energy Service Centre
SC	Steering Committee
SE	Solar Energy
SEMAN	Solar Electric Manufacturers' Association Nepal
SHS	Solar Home System
SIDA	Swedish International Development Assistance
SNV-N	Netherlands Development Organisation Nepal
UNDP	United Nation Development Programme
VDC	Village Development Committee
WB	The World Bank
WECS	Water and Energy Commission Secretariat

List of Tables

List of Figures

Chapter One: Introduction

1.1. Country Background

Nepal is a sovereign independent country situated in the foot hills of the Himalayas in South Asia with an area of 147,181 sq. km (IEA 2010). It is located between 26°22'N to 30°27'N latitude and 80°4' to 88°12' E longitude (CIA 2010) .The location of latitude within 35 degree from the equator means it is a favourable environment for solar energy resources, because of low diffuse radiation at higher altitude and increasing albedo factor due to snow (Rijal and Bansal 2000,13). This landlocked country is bordered by India in the east, south and west and by China in the North with about 800 km of Himalayan range as shown in figure 1 below. The altitude varies from 70 meters to almost 8848 meters showing potential for enormous hydropower generation. The country has been divided into 5 development regions containing 14 administrative zones, 75 districts and 3913 village development committees at the ground level (CIA 2010).

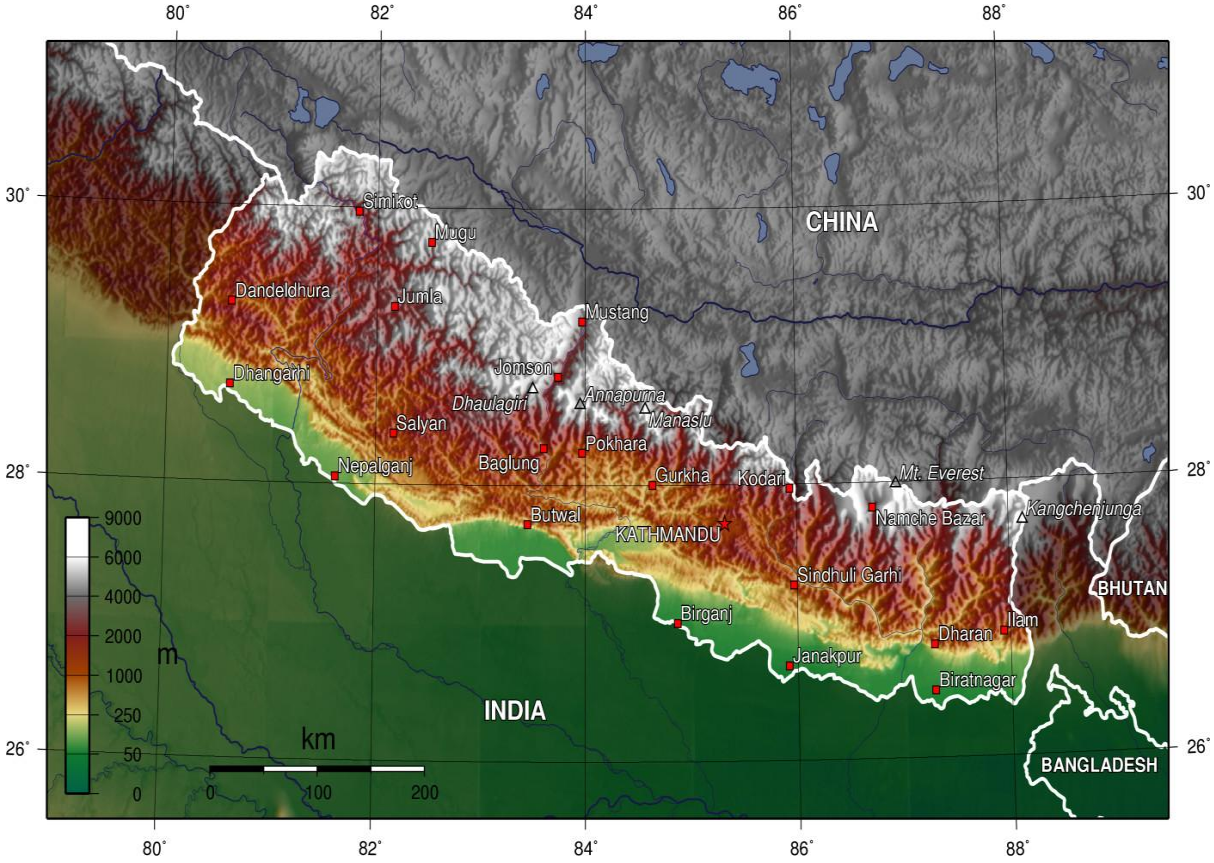


Figure 1: Topographic Map of Nepal

(Juggle 2011)

1.2. Economic Outlook

The small landlocked country has a population of around 29 million (Nepal CBS 2011) where almost 35% of the population are under the national poverty line defined as US $160 per day (ABD 2011, 165). The same report stated in FY2010, GDP growth rate is around 4% whereas the inflation rate is 10%. As per the data of FY2009 provided by Finance Ministry, Government of Nepal, GDP per capita of the country is just US$470 (Nepal Ministry of Finance 2011). In 2008, the electricity consumption per capita was around 90kWh, which is just about 1% of Australia's per capita electricity consumption (IEA 2010).

1.3. Energy Status

More than 80% of the country's population live in rural areas and are meeting their energy needs from traditional resources (87%), such as fuel wood, agricultural residue, cattle dung etc (WECS 2011, 12). Energy supply and balance statistics show that the major consumption of energy in Nepal is in the domestic sector, whereas the major supply of energy comes from biomass, of which fuel wood is the dominant energy source, as it covers 77 percent of the total biomass energy supply in Nepal. The other energy supply sources like non-renewable (oil and gas) and renewable energy cover 11.76 percent and 0.53 percent respectively of the total energy supply (WECS 2011, 12).

One of the interesting facts is that although Nepal is blessed with natural resources and a steep gradient topography, it has harnessed only 650 MW of 43,000 MW (1.51%) of technically and economically feasible potential of hydropower (Nepal Ministry of Finance 2011, 164-175). It does not have any fossil fuels suitable for power generation.

Renewable Energy

The large proportion of the population from rural areas and their massive dependence on traditional energy resources show that the rural sector is the most important sector for the implementation of the concentrating development programs to accelerate the country's development index. The low consumption level of imported energy shows that the industrial activity is very low whereas household energy dominates the major energy portion of the market. Due to the geographical terrain, it will cost massive investment and time to link rural areas with the national grid. Based on this fact, the government started to promote locally available environmentally friendly renewable energy resources in Nepal which are more affordable to those rural populations, helping to raise the rural economy. The National

Planning Commission (Nepal National Planning Commission 2008) stated in its report that there is technically feasible potential of 50MW micro hydro power, 1132.7 MW of solar energy (considering 5% of the area potentially suitable @ 4-5 kWh/sq.m/day) and 1.9 million biogas plants.

The Government of Nepal (GoN) has established the Alternative Energy Promotion Centre (AEPC) in 1996 for the promotion of renewable energy technologies in Nepal. The main programmes are micro hydro, solar and biomass (bio-diesel, cooking stoves, and biogas). Currently, AEPC is coordinating with Ministries, GOs, donors, INGOs, NGOs, the private sector and stakeholder/user groups to make policy recommendations to the government. For the small scale RE deployment, it acts as a one door channel for the mobilization of funds. There are different programs under AEPC funded via unilateral, bilateral donor organizations (AEPC 2010) which will be discussed in detail in chapter three.

The GoN has subsidized almost all of these renewable energy technologies through the "Rural Energy Policy 2006" revised in 2006 and 2009. The supporting policies are "Subsidy Policy for Renewable (Rural) Energy" and Renewable (Rural) Energy Subsidy Delivery Mechanism" (AEPC 2010). The Subsidy Policy defines objectives as well as the types, level of subsidy and the delivery mechanism (AEPC 2010). Since the programme is running since last 15 years, there is a need for the evaluation and Analysis of the Impacts of Subsidies on Small Scale Renewable Energy Technologies Dissemination in Nepal (AEPC 2010a).

1.4. Objectives

The main objective of this research based project is to analyse:

- the status of rural electrification using RETs in Nepal; and
- current delivery modality of RETs dissemination in Nepal

The specific objectives of this project are:

- Identification of RETs being subsidized
- Evaluation of the effectiveness of the subsidy with current subsidy delivery modality
- Identification of the gaps in the current subsidy delivery modality
- Proposed improved subsidy delivery mechanisms filling the gaps identified.

1.5. Research Questions

To understand the objectives, a series of research questions will be addressed.

1. How effective is the current subsidy programme in assisting the target groups?
2. What will be the impact on projects if subsidies are discontinued?
3. What are the social costs of having or not having subsidies for the promotion of RETs in Nepal?
4. What is the effect of the current subsidy on other RETs?
5. Are subsidies targeted at right level, in the right areas?
6. What is the technological integration effect in the subsidy programme?

1.6. Rationale of the Study

There are different types of renewable energy financing programmes. Subsidy is one among those programmes. Also, even with subsidy options, there are a wide variety of approaches including subsidy to producers, fuel subsidy, consumer subsidy, grants, tax exemptions etc (UNEP 2008, 9). The same UNEP report also states that in most developing countries, energy subsidy programmes are designed to raise the living standards of rural and poor communities; examples could be subsidies in cooking, heating etc.

"Many energy subsidies programmes intended to boost poor households' purchasing power or rural communities' access to modern energy can paradoxically leave the poor worse off" (UNEP 2008, 17). So, any subsidy program that has been implemented over a period should be assessed to make sure that a programme is running in an effective and efficient way while reaching the target group. As the Government of Nepal is subsidizing almost all renewable energy projects, it is important to evaluate and analyse the programme. This will be useful for all the relevant stakeholders to know about the effectiveness of current subsidy policy and delivery modality, as many of those are deprived of this information.

1.7. Limitations

The limitations of the projects are:

- The study has only considered solar home systems, metal stoves and micro hydro power as the small scale renewable energy technologies (RETs) for assessment.

- The study is only focussed on RETs disseminated by Energy Sector Assistance Programme (ESAP) under AEPC umbrella.

- As the author is currently Australia based, all the data gathered are based on survey questionnaire and the e-communication with people in Nepal.

1.8. Study methodology

Literature review

The comprehensive literature review has been done. It started with the identification of the case studies of subsidy programmes operating in some neighbouring countries, with Bangladesh being a focus. Then the study was more focussed on "The Rural Energy Policy 2006" and Renewable (Rural) Energy Subsidy Delivery Mechanism as they operate in Nepal. Other government plan and policies related with rural renewable energy, electricity had been studied which includes the documents from the Ministry of Finance, Nepal Rastra Bank, National Planning Commission. All the information from these different sources was systematically studied and analysed.

Field Visit

During the course of the study primary information collected from the field has been compiled using appropriate tools/software (such as MS Office) and analyzed. There were two field visits to Nepal during the semester break. Different sets of questionnaires were prepared targeting different personnel ranging from the users' level to the government policy level. The systematic plan of the field visit was in close co-ordination with ESAP/AEPC.

Field Data Collection Method

The following field survey methods have been used to collect primary information and data required for REF subsidy users' study from the field to identify barriers to subsidy delivery and possible measures to overcome barriers; to determine user satisfaction level and time period for subsidy delivery mechanism:

- Field Observation of RETs Installations and operation
- Interviews with selected users on random sampling basis

Sampling Size and Place

The survey question follows the guidelines of the Human Ethics Committee of Murdoch University. Random sampling has been done. In total, 110 survey questionnaires have been carried out. Among them, 80 survey questionnaires are from RETs users from 15 districts of the country comprising of different geographical areas. The remaining 40 are from manufactures/installers/supplier and policy makers.

1.9. Structure of the Report

The report has been structured in layout as follows:

Chapter 1: Includes the project background and rational for this study.

Chapter 2: Contains literature review and the information on small scale RETs currently disseminated in Nepal

Chapter 3: Includes the organizational setup in this sector and subsidy delivery modality with an example.

Chapter 4: Includes the survey questionnaire details.

Chapter 5: Contains the analysis of an effectiveness of the subsidy programme in terms of six standard criteria

Chapter Six: Contains Conclusion and Recommendation along with future works.

The starting of the new topic is indicated by bold “heading”. The author has tried to structure the report in a best possible way to avoid text repetition.

Chapter Two: Literature Review

The literature reviews of different national and international documents were completed in the beginning phase of the research work. The renewable energy subsidy schemes in neighbouring countries like India, Bhutan and Bangladesh have been studied. The Bangladesh case study has been reviewed here more specifically, as the author has incorporated its subsidy delivery concept in the recommendation part of the study.

2.1. Case study of Rural Electrification in Bangladesh

Bangladesh is one of the developing countries located in South Asia. It has a maximum electricity generation capacity of 6727MW electrifying 49% of its total population (Bangladesh Ministry of Power, Energy and Mineral Resources 2011). Though the main energy sources are biomass (traditional) and natural gas, the government is expanding its renewable energy program for rural electrification (Bangladesh. Ministry of Power, Energy and Mineral Resources 2011).The solar dissemination program is one of the exemplary programs of government in collaboration with donor agencies (World Bank, GEF, kfW, GTZ etc.) along with other partner organizations, NGOs and private bodies. These programs are being implemented through Infrastructure Development Company Limited (IDCOL), Rural Electrification Board (REB), Local Government Engineering Department (LGED) and Bangladesh Power Development Board (BPDB) (Bangladesh Ministry of Power, Energy and Mineral Resources 2008). The solar PV electrification program is a kind of subsidized program (in the form of a grant) being delivered in a commercial way which seems more sustainable than direct subsidies.

The programme has been financed in two ways:

- "Fee for service" implemented by Rural Electrification Board (REB): Consumers pay monthly bill based on consumption.
- "Credit sell" option followed by Grameen Shakti, LGED and BPDB.

(Urmee 2009)

Implementation Modality of Infrastructure Development Company Limited (IDCOL)

The government supports the program with favourable policies; for example, the Government of Bangladesh exempt import duty and Value Added Tax (VAT) from solar photovoltaic and

wind turbines in 1998 (Bangladesh Ministry of Power, Energy and Mineral Resources 2011, 3-8). They also act as a mediator to source the fund through different donor agencies. IDCOL works through Partner Organizations (POs) (IDCOL 2010). They provide soft loans to them and give technical assistance. They are more focussed on commercialization of technology which is considered to be one of the main bases for sustainable markets, hence provide capacity building programs as well. POs are the implementing organizations responsible for selling the systems, installation and after sales service. They apply microcredit system so that the people can afford the system in a reasonable time. One of the partner organizations is Grameen Shakti. It follows 4 different modes of payment under which customer have to pay 15%-25% of the cost as down payment and repay the remaining under several monthly instalments and Cash sell option followed by Grameen Shakti (Grameen Shakti 2011).

Mode-1:

- "The customer has to pay 15% of the total price as down payment.
- The remaining 85% of the cost are to be repaid within 36 months with 12% service charge.

Mode-2:

- The customer has to pay 25% of the total price as down payment.
- The remaining 75% of the cost are to be repaid within 24 months with 8% service charge.

Mode-3:

- The customer has to pay 15% of the total price as down payment.
- The remaining 85% of the loan amount, including 10% service charges, are to be repaid by 36 account payee cheques in advance.

Mode-4:

4% discount is allowed on listed price in cash purchase" (Grameen Shakti 2011).

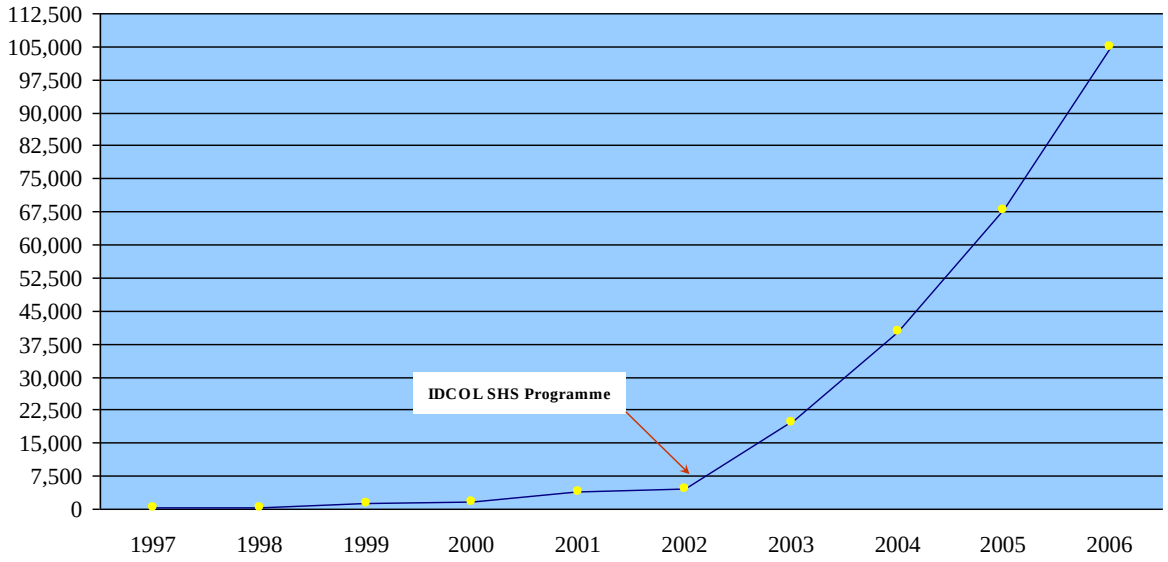


Figure 2: Installation of Solar Home System in Bangladesh

(IDCOL 2010)

Figure 1 shows the sharp increase in the installation of solar home systems in Bangladesh after the implementation of the IDCOL program. The renewable energy program and subsidy delivery modality of Bangladesh can be one of the good examples to compare with the renewable energy program of Nepal, where commercialization still hasn't take place properly and companies are totally dependent on government subsidy to run the program.

2.2. Energy Policy Framework of Nepal

National Planning Commission (NPC) is the apex body in Nepal for "...formulating development plans and policies of the country under the directives of the National Development Council" (Nepal National Planning Commission 2008a, 1). The same source states that the NPC, chaired by the Honourable Prime Minister, have to approve all central level plans and programmes before its implementation. All plans and policies are generally based on a 5 year period (FYP). The Sixth Five-Year Plan (1980–1985) incorporated the concept of sustainable development and formulated the Environmental Protection Act and Regulation Act and ratified different international treaties and conventions related to the environment. There were some donor supported activities in RETs running on a very small scale, but only in the Eighth Five-year Plan (1992-1997) did the government realize the need for a separate body for the promotion of alternative energy and hence, AEPC was formed in 1996 with the objective of promoting clean energy to the rural communities and hence, help

to raise their livelihoods. In the Tenth-Five-year-Plan (2002-2007), the government set poverty alleviation as a theme. Among the various sectoral activities to achieve the goal, energy is considered as one of the key sectors falling in the "Priority category 1", which is the sector in Poverty Reduction Strategy (PRS) (Nepal National Planning Commission 2008a, 1). In between the period of 2002-2007, nearly 170,000 biogas plants, 5 MW of micro and pico hydropower have been installed, as well as 81,000 solar home systems and 213,000 improved cooking stoves, electrifying a total of 5.1% of the rural population (Nepal National Planning Commission 2008, 228). Renewable Energy Subsidy Mechanisms and other procedures were also formulated in the same period. Only the target has been revised in the Three-Year-Interim-Plan (2008-2011).

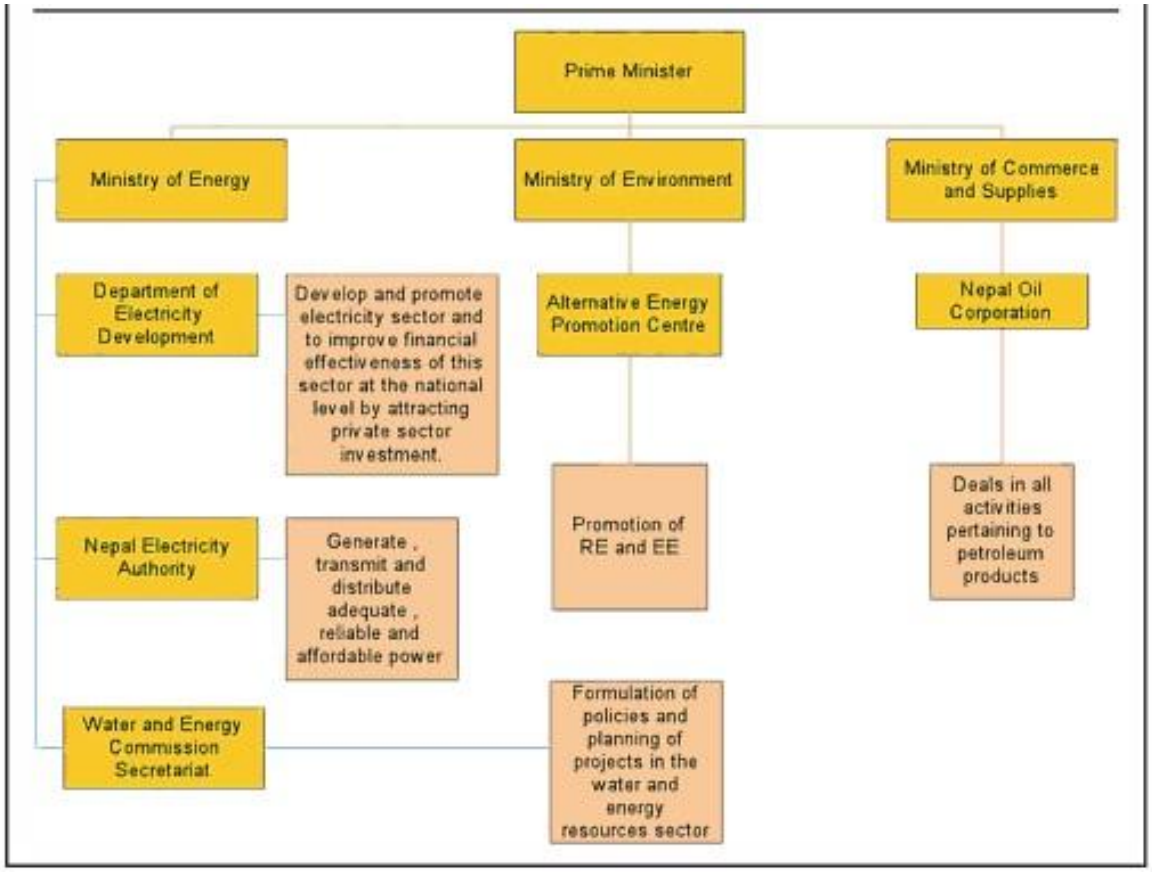


Figure 3: Institutional Setup

(Banerjee et al. 2011, 4)

Figure 3 demonstrates the general institutional setup of the country. It shows all the relevant stakeholders dealing with the overall energy sector with their hierarchy. Figure 4 below shows the timeline of all policy initiatives taken in Nepal. The energy sector is considered to be the one of the youngest sector as the main initiative was just taken in 1975 A.D (Banerjee et al. 2011, 4).

.

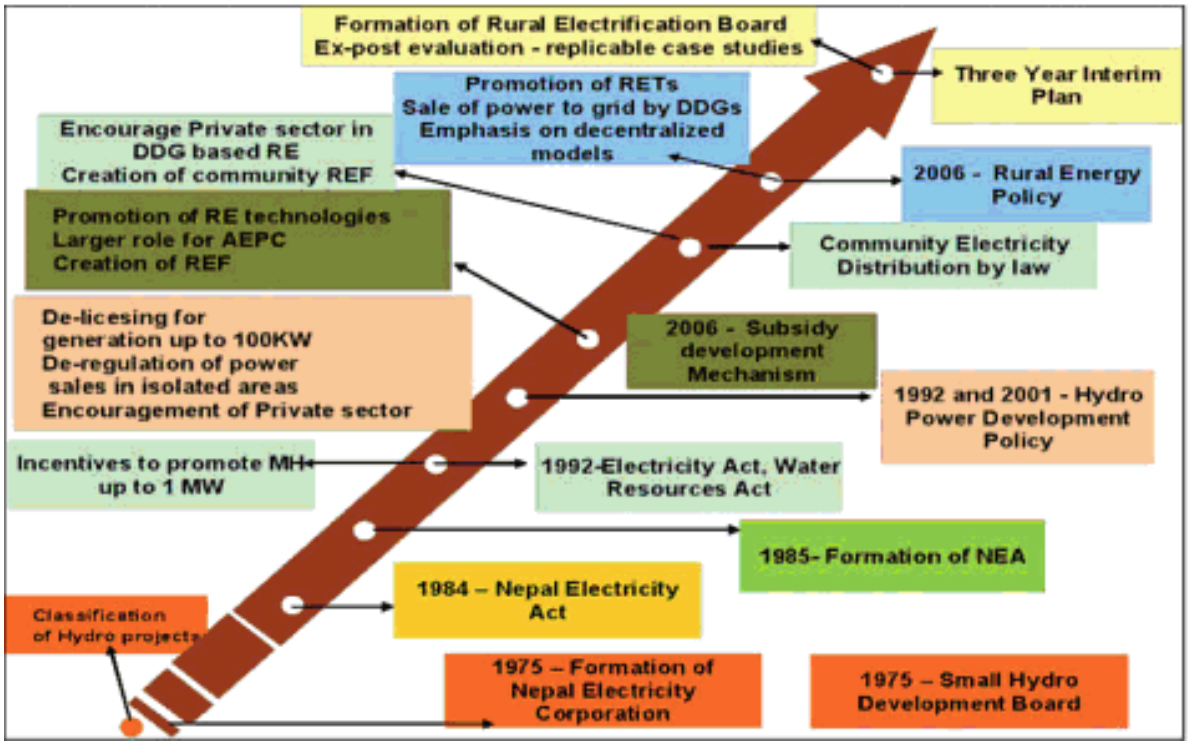


Figure 4: Timeline of Policy Initiatives

(Banerjee et al. 2011, 4)

2.3. Key Government Bodies and Policies

To provide an indicator of the complex range of government that have an impact on the overall sector, the following are the list of Ministries and other government bodies involved in the sector and working on different acts and policies.

- The National Planning Commission (NPC)
- The Ministry of Environment (MoE)
- Ministry of Science and Technology (MoST)
- Ministry of Finance (MoF)
- The Ministry of Local Development (MoLD)
- The Ministry of Water Resources (MoWR)
- The Ministry of Forest and Soil Conservation(MoFSC),
- The Ministry of Industry, Commerce and Supplies (MoICS)
- The Ministry of Labour and Transport Management (MoLT)
- Nepal Electricity Authority (NEA):

- The Water and Energy Commission Secretariat (WECS)

Source: (Nepal Ministry of Environment 2010), (Nepal Ministry of Science and Technology 2010), (Nepal Ministry of Energy 2010) and (Nepal Ministry of Forest and Soil Conservation 2010)

The simple example could be AEPC falling under the Ministry of Environment (MoE). There are different Ministry for Water Resources and Energy. Though these two ministries have different working mandates, they both are working in water resources/energy and hence run into each other at different stages of the program. This simply makes the process more bureaucratic. Another example is the way government staff is utilized in the District Development Committee (DDC) in all districts. As DDC falls under the Ministry of Local Development (MoLD), AEPC has to coordinate and reach consent with the MoLD through the MoE.
In biofuel policy formation for example, six Ministries (MoE, MoFSC, MoICS, MoLT, MoF, MoST) had to work together (Author Experience, 2009).

There are also regional and district level of line agencies like the District Development Committee etc. The various acts and rules (government policies) which are governing the energy sector a direct or indirect way are as follows:

- Nepal Petroleum Act – 1983
- Petroleum Rules – 1984
- Nepal Electricity Authority Act – 1984
- Electricity Act – 1992
- Hydro Power Development Policy – 1992, 2001
- Forest Act – 1993
- Water Resource Act – 1993
- Industrial Enterprise Act – 1992
- Water Resource Regulation – 1993
- Electricity Regulation – 1993
- Forest Rules – 1994
- Environment Protection Act – 1996
- Environment Protection Rules – 1997

Source: (Nepal Ministry of Environment 2010), (Nepal Ministry of Science and Technology 2010), (Nepal Ministry of Energy 2010) and (Nepal Ministry of Forest and Soil Conservation 2010)

2.4. Renewable Energy Subsidy Policy

The renewable energy subsidy policy was formulated in 2000 and has been revised twice since, in 2006 and 2009. It is supported by the Subsidy Delivery Mechanism 2000 which incorporates the process to channelize the government subsidy for users via the Rural Energy Fund (AEPC 2010, 1). The RE policy has targeted the following objectives:

- "To maximize the service delivery and service delivery efficiency in the use of renewable energy resources and technologies in the rural areas and to provide opportunity to low-income rural households to use RETs.
- To support rural electrification as well as gradually reduce the growing gap of electricity supply, consumption, etc. between rural and urban areas.
- To make the use of grant assistance provided by donors, existing and forthcoming, in a more effective and objective oriented way and thereby attract additional donors and other investor in RETs sector.
- To support development and extension of RET market by attracting private sector entrepreneurs.
- To support to the envisaged long-term targets of GON in providing rural electrification and energy services "(AEPC 2010, 2).

How the policy works in a practical situation is addressed in detail in the following sub-chapter.

2.5. Small Scale Renewable Energy Technologies

The most effective renewable energy technologies in Nepal are micro and pico hydro power, improved water mills, solar PV and thermal, improved cook stoves and biogas. Wind energy is still in the beginning of its dissemination stage, as policy and delivery modalities are just finalized (AEPC 2010a).

This study will be limited to three technologies, which are micro hydro power, metallic cook stoves and solar home systems.

2.5.1. Micro Hydro power

This is one of the most prominent technologies disseminated for rural electrification in Nepal. Being blessed with enormous water resources, the country has around 600 perennial rivers, as shown in figure 5, giving an annual average run off of over 200 billion cubic meters (IEA 2011). The report has estimated that there are altogether "...6,000 rivers with drainage density of about 0.3 km/km2. The cumulative length of rivers is 45,000 km" (WEPA 2011).

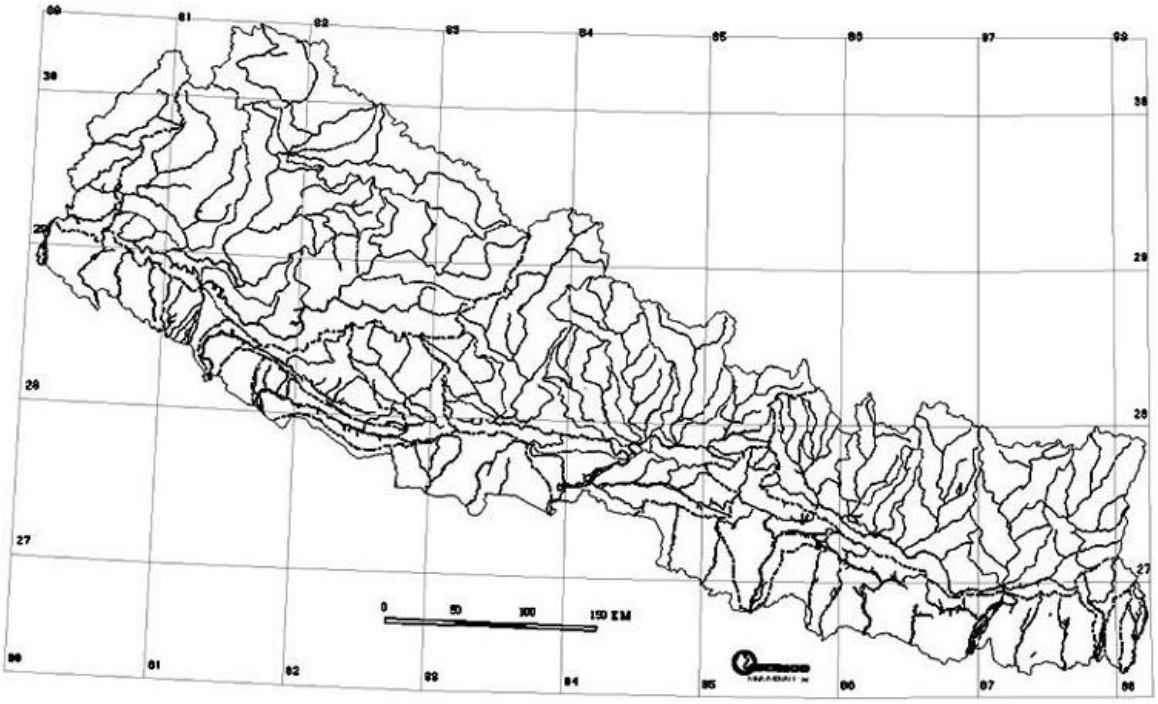


Figure 5: Network of River in Nepal

(Rajbanshi 2002)

The same report states that among those rivers, 1000 rivers are longer than 10 km and about 24 of them are longer than 100 km. Also, micro-hydro generates electricity throughout the

year with no storage dams, and hence will be a more cost effective technology for the scattered communities living in mountains. The government has estimated that more than 50 MW of micro hydro power plants could be installed in the mountainous areas. Another advantage is that the day time energy can be utilized in end users activities such as agro processing mills, pumping and other income generation activities. A Hydropower plant with capacity less than 100 kW is considered to be a micro hydro program while power plants between 100 kW to 1 MW fall under Mini grid program (AEPC 2011).

2.5.2. Solar Photovoltaic Power (Solar Home System)

Nepal is blessed with 300 days of sunshine throughout the year. The government has estimated the total potential at 1132.7 MW of solar energy considering 5% of the area potentially suitable at the rate of 4-5 kWh/sq.m/day (Nepal National Planning Commission 2008), as it can be seen from figure 6 below. Traditionally, solar energy is being used for drying and water heating purposes. PV systems between 5 -10 Watt are considered to be small solar home systems whereas systems above 10 Watt are known as solar home systems (AEPC 2011).The systems are being used for lighting purposes and for some electronic appliances such as radio, TV etc. Bigger systems are also being disseminated for drinking water pumping, medical storage, and mobile communication. These technologies provide an alternative to traditional rural lighting systems such as Jharro (bark of tree), kerosene which have serious health impacts (Zahnd 2010).

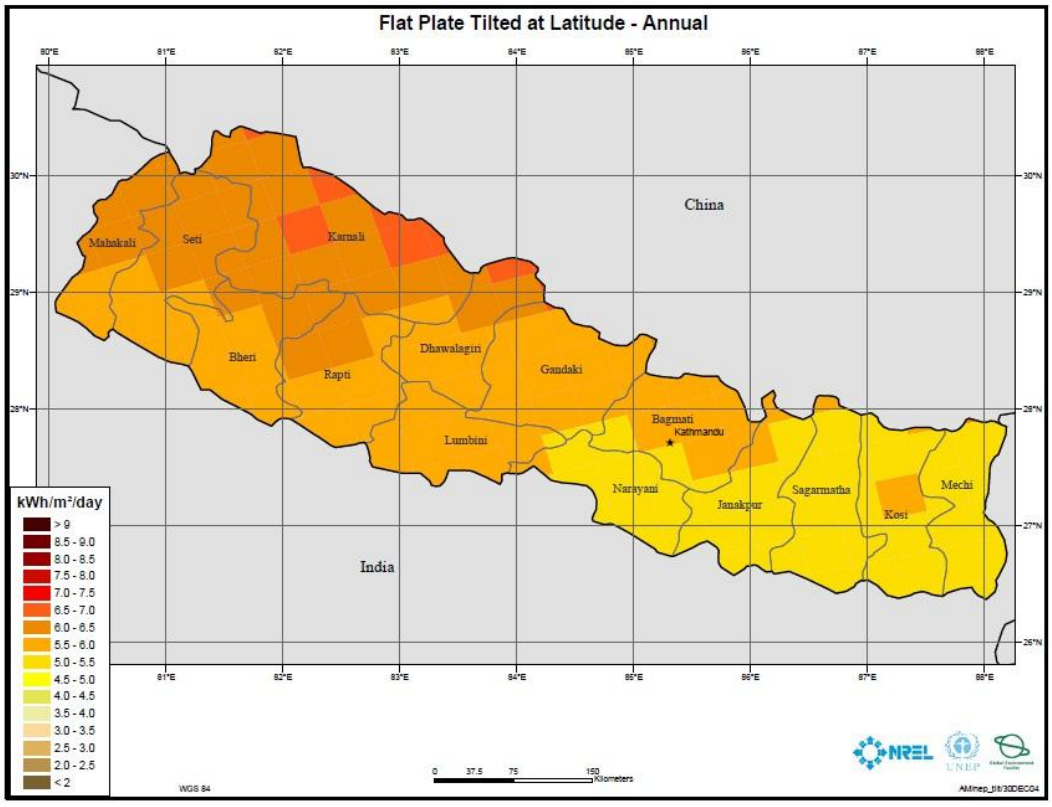


Figure 6: Annual Solar Irradiation at latitude angle

(SWERA 2010)

2.5.3. Biomass Energy(Metallic Improved Cook Stoves)

More than 80% of the Nepalese people are dependent on traditional resources such as fuel wood, agricultural residue, cattle dung etc., of which fuel wood accounts for 77 percent of the total biomass energy supply in Nepal (WECS 2010).In order to use these resources efficiently and effectively in a sustainable way and to address the related health and environmental issues, the government focussed on large scale dissemination of improved cook stoves. The government is promoting different types and sizes of mud and metal stoves targeting different geographical areas. Figure 7 shows the different technologies being promoted.

Figure 7: Types of ICS being promoted

(Biomass Energy Support Programme/ESAP)

2.5.4. Key Institutions

Apart from the key government institutions and AEPC, there are many key institutions involved in the promotion of small scale RETs in Nepal.

2.5.4.1. Donor/Financing Agencies

The main donor and financing agencies supporting this sector are

- Danish International Development Agency (DANIDA),
- Norwegian Agency for Development Corporation (NORAD),
- United Nation Development Program (UNDP)
- World Bank (WB)
- Kreditanstalt für Wiederaufbau - Development Bank of Germany (KfW)
- Netherlands Development Organisation (SNV)
- European Union (EU)
- Asian Development Bank (ADB)
- The U.S. Agency for International Development (USAID)
- Nepal Bank Limited

- Rastriya Banijya Bank Limited
- Clean Energy Development Bank Ltd

(Survey 2010/11)

2.5.4.2. International and National Non-Government Organizations (INGO/NGOs)

Significant numbers of INGOs and NGOs are working in this sector. Some of the programs are focussed on direct promotion of these technologies while most of the programs are being integrated with gender, poverty etc projects. Some of the major organizations are:

- International Union for Conservation of Nature (IUCN)
- International Centre for Integrated Mountain Development (ICIMOD)
- Winrock International
- Practical Action
- Biogas Support Program-Nepal
- Centre for Rural technology (CRT/N)
- Rural Integrated Development Services (RIDS-Nepal)
- Himalayan Light Foundation
- Clean Energy Nepal (CEN)
- Gender in Energy and Water Network (GEWNet)

The list of the donor organizations and non-government sector also indicate that this sector has recently got the attention from a large number of bodies. This will increase the total fund of the sector and ultimately result in a large number of beneficiaries. However, lack of proper policy and coordination between the government bodies and agencies could result ineffective utilization of the fund.
(Survey 2010/11)

2.5.4.3. Private Sector

This sector consists of Independent Power Producers (IPP), manufacturing companies, installing companies, contractors and consulting firms. Government qualified manufactures, suppliers and installers in solar, micro hydropower, improved water mill, biogas, have already formed their national association in order to serve the consumers more effectively.

Solar Electric Manufacturers' Association Nepal (SEMAN) for Nepalese Solar Photovoltaic System Manufacturing Companies, Nepal Micro Hydro Power Development Association (NMHDA) for micro hydro and improved water mill manufacturers and installers, Water and Energy Consultant's Association (WECAN) are some of the major association.

(Survey 2010/11)

Chapter 3: Organizational Setup and Subsidy Modality

3.1. Overview: Alternative Energy Promotion Centre

The Government of Nepal established AEPC in 1996 for the purpose of promoting renewable energy technologies and encouraging the efficient use of conventional sources of energy, specifically in rural areas. It is a semi-autonomous body governed by the AEPC board which consists of representatives from GOs, NGOs, the private sector and donor/financing organizations. AEPC is as main regulatory body with mandate to develop renewable energy policy, planning, implementation, coordinating, monitoring and evaluation and assuring of the standard of the service (AEPC 2010a).

3.2. Working Modality

AEPC highlights the importance of the public private partnership (PPP) approach for the long term sustainability of the overall sector. In this modality, as shown below in figure 8, the promotion of RETs is demand driven rather than supply oriented.

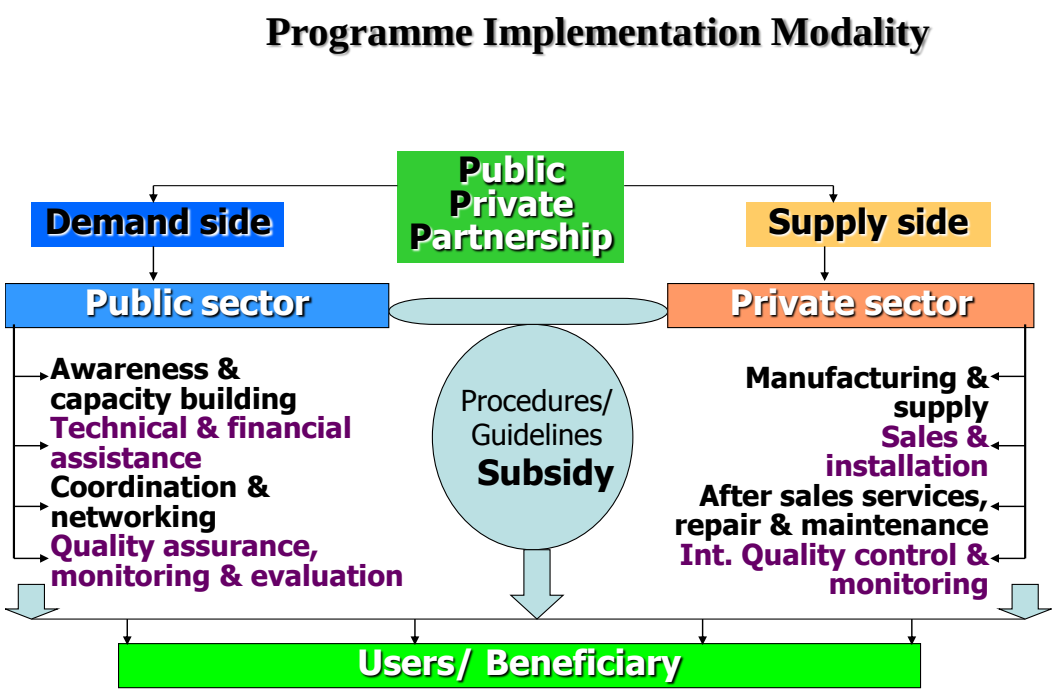


Figure 8: AEPC Implementation Modality

(AEPC 2010b)

The government, as a public sector, prepares the plans and policies in consultation with all relevant stakeholders. The main role of AEPC on behalf of the government is to facilitate and coordinate the overall program. It creates the demand for RET services via conducting awareness and capacity building programs, therefore creating a market for the private sector. It monitors and evaluates the market so as to assure the quality of the product which is the most important factor to maintain or increase the user confidence of RETs.

The private sector as shown in figure 8 is responsible for manufacturing, installing and supplying the product as per the consumer demand. They are also liable for after sales service followed by repair and maintenance within a fixed time period based on the government rules and regulation.

3.3. Programs and Activities

The following are the working areas of AEPC:

- Mini and Micro hydro Power
- Solar Photovoltaic and Thermal (Small scale-Non grid)
- Biomass (Improved Cook Stoves, Wood fired Gasifiers, Non electrification)
- Bio-fuels
- Biogas
- Wind Energy (Small scale-Non grid)
- Improved Water Mill
- Energy efficiency
- Climate Change and Carbon Trading

Currently, there are six main programs being implemented under AEPC. These are funded by various donor organizations and are summarized in table 1.

Table 1: AEPC Programs and Activities

.No.	Program	Period	RETs Implemented	Website
1.	Energy Sector Assistance Program (ESAP)- Phase II (Phase I : 1999-2005 followed by 2 year bridging period for Phase II)	15th March 2007- 14th March 2012	Mini Grid, Micro hydro, Solar PV ,Improved cook stoves via Rural Energy Fund	http://www.aepc.gov.np/
2.	Rural Energy Development Programme (REDP)- Phase III (Phase I: 1996 – 2003 Phase 11: 2003-2007) Succeeded by The Renewable Energy for Rural Livelihood (RERL)	(August 2007 – 2009 extended till 2011) April 2011- December 2012	Micro hydropower	http://www.aepc.gov.np/
3.	The Khimti Neighbourhood Development Project (KiND)	June 2007- June 2011	Small hydropower	http://www.hpl.com.np/social_khimti.php
4.	Renewable Energy Project (REP)	2003- 17th August 2011	Institutional Solar PV, solar thermal	http://www.rep.com.np/

5.	Biogas Support Programme (BSP)- Phase IV (Phase I: 1992-1994 Phase II: 1994- Feb 1997 Phase III: March 1992-June 2003	July 2003 – June 2010 and extended	Biogas	http://www.bspnepal.org.np
6.	Improved Water Mill Programme (IWM)	2003- June 2012	Improved water mills	http://www.crtnepal.org/

(AEPC 2010b)

3.4. Energy Sector Assistance Program

3.4.1. Background

The Energy Sector Assistance Programme, hereafter known as ESAP, was established for the promotion of the renewable energy sector in Nepal in line with the Government of Nepal's commitment of mainstreaming renewable energy in order to raise the economic standard of the people as described in its Eighth-Five year Plan. In 1996, the Government of Denmark and the Government of Nepal agreed to implement ESAP as a bilateral support program executed through DANIDA (Ministry of Foreign Affairs of Denmark from the Danish Government) and AEPC (from the Government of Nepal). The program was initially premeditated to support the sector for 20 years of time via a series of five year plans (AEPC 2010).Both governments signed the agreement, contributing Danish Kroner DKK154 Million (US$ 28 Million) in March 26, 1999(ESAP 2006)..

Later on, NORAD, representing the Government of Norway, joined ESAP investing Norwegian Kroner NOK12 million (US$ 6.14 Million) in August 2003 in response to the GoN's request for financial assistance for augmented sector demand (ESAP 2006). ESAP Phase I ended in September 2004. The political instability in the country caused Phase II to be delayed by almost 3 years as the Governments of Denmark and Norway suspended their funding. Phase II started on March 15, 2007 and will last for 5 years, ending on March 14, 2012. During the bridging period (Between Phase I and II), the programme survived by utilizing the unspent programme budget and an additional NOK23.5 Million (US$ 4 Million) support provided by NORAD and 37.3 DKK(US$ 6.77 Million) from DANIDA when the political situation became more hostile (ESAP 2006). Table 2 below shows the time frame of ESAP Phase I in detail. In total, the Government of Nepal contributes Nepalese Rupees (NRs) 99.6 Million (US$ 1.21 million) (ESAP 2006).

The total expenditure of ESAP Phase I including bridging period is US$ 43.12 Million using the exchange rate as of 10th November 2011 (Currency Converter 2011).

Table 2: ESAP Phase I Timeline

Phase	Dates
Programme Phase 1	March 1999 - March 2004
Programme Phase I no cost extension	April 2004 - September 2004
Programme Bridging Phase	October 2004 - June 2005
Programme Bridging Phase no cost extension 1	July 2005 - June 2006
Programme Bridging Phase no cost extension 2	July 2006 - March 2007

Source: (AEPC 2010a)

3.4.2. Objectives

The objectives of the two phases of the program were as follows:

ESAP Phase I:

"Improvement of the living conditions of the rural population by easing its access to energy technologies with better performance in terms of productivity, use versatility and environmental impacts" (ESAP 2006, 21-28).

ESAP Phase II:

"Improve the living conditions of the rural population by enhancing their access and affordability to rural energy solutions that are efficient, environment-friendly and that address social justice" (ESAP 2006, 21-28).

3.4.3. Strategy

The major strategies of ESAP Phase II are as follows:

- "Development of a coherent rural energy policy which adequately addresses the energy needs of the rural population and the rural energy objectives of the government through Public-Private Partnership (PPP),
- Rural energy subsidy policy with clear objectives and criteria addressing target groups* and sufficient funds allocated to implement the policy,

- Development and enforcement of efficient and effective credit systems with involvement of local banks and other credit facilities, viz., leading the sector towards credit regime from subsidy regime,
- Standards for energy technologies are developed and systems for monitoring hardware quality and quality of services for reliability and preparation and dissemination of manuals for services
- Social Impact Assessments of rural energy programs systematically undertaken and identified issues are timely resolved
- Institutional strengthening of rural energy sector
- Ensuring rigorous monitoring and transparency through public performance auditing and information dissemination" (ESAP 2006, 21-28).

3.4.4. Programmes and Components

The ESAP Programme mainly emphasized three technologies from the beginning and these are supported by capacity development/institutional strengthening of the sector for long term sustainability, assuming that the market will run by itself without any external support or subsidy. Table 3 shows the main programs and components of ESAP Phase II:

Table 3: ESAP Phase II Activities

S.No.	Component	Technologies/Activities
1.	Biomass Energy Support Programme (BESP)	Mud and Improved Cook stoves, Gasifiers, biofuel
2.	Mini Grid Support Programme (MGSP)	Pico hydro power, Micro Hydro Power, Mini Grid Electrification
3.	Solar Energy Support Programme (SSP)	Solar PV lighting, pumping
4.	Rural Energy Fund (REF)	Mobilizing subsidy fund
5.	Institutional Strengthening of Rural Energy Sector (ISRES)	Sector Capacity development , policy formulation

(Survey 2010/11)

3.4.5. Programme Implementation Modality

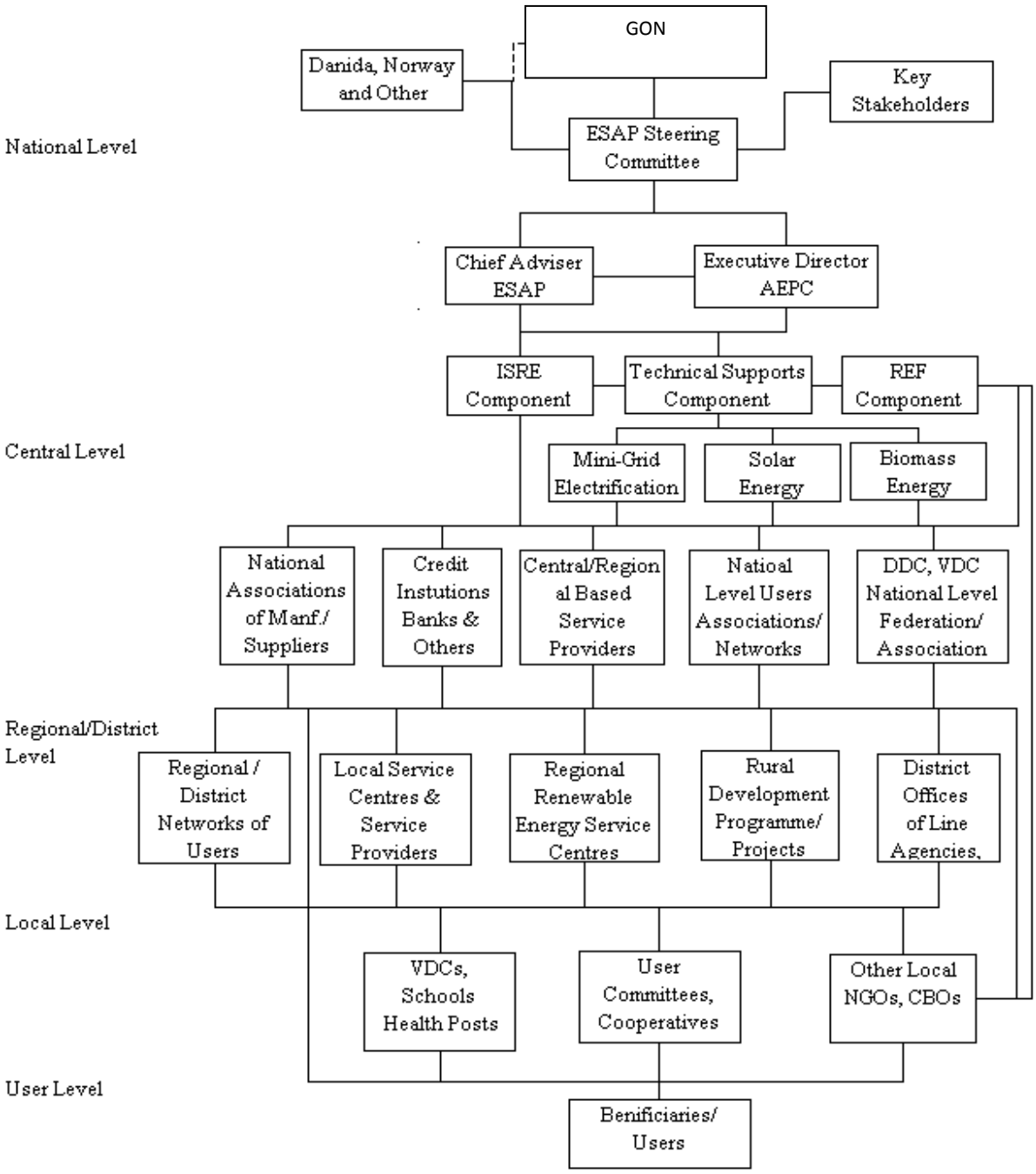


Figure 9: ESAP Implementation Modality

(ESAP 2006)

The Executive Director of AEPC is the head of the ESAP organization and is assisted by the Chief Advisor who is appointed by DANIDA in coordination with AEPC. CA, ESAP will be

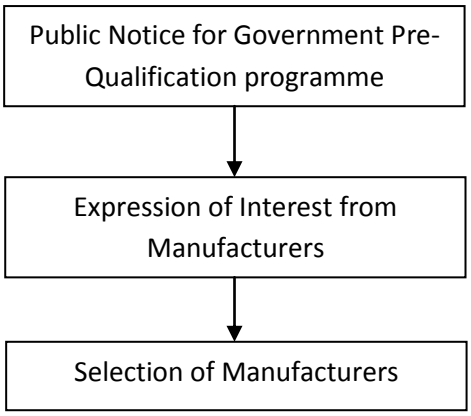
supported by program hired managers, officers and other supporting staff reporting jointly to ED, AEPC and CA, ESAP. Figure 5 above shows the delivery modality of ESAP. The program is implemented through different NGOs at the regional level. The main concept behind the modality is to increase the capacity of the NGOs and private sector for sustainable development with the support of government bodies. In the long term, the program is designed to be handed over to government bodies, thus confirming that the program can run with minimal or no external support.

The Government of Nepal, donor agencies and key stakeholders formed the ESAP steering committee which is responsible for planning and implementing the activities in an efficient and effective way. At the central level, the program components work with national level NGOs, manufacturers, suppliers, credit agencies etc. For example, BESP works with National level NGOs known as Rural Renewable Energy Service Centres (RRESCs). They give financial and technical support to RRESCs which in turn are responsible for selecting district/village level NGOs to implement the program at the ground level. The other supporting actors would be government units (eg: District Development Committee, Village Development Committee), local user groups from community and other development agencies working in the same area. In this way, program goes from central level to ground level (ESAP 2006).

3.4.6. Metallic Stove Subsidy Delivery Modality

As an example of the way, subsidies are delivered in Nepal, the case of a Nepali study will be considered. In this case, the process consists of three steps.

STEP 1: Initial Call



(Survey 2010/11)

This is the very basic step in the selection of manufacturers/suppliers/installers aka pre-qualified (PQ) companies for the government subsidy programme. In general, the respective program, (Solar, Biomass and Micro hydro program) in coordination with AEPC will form a selection committee. They are responsible for defining standard criteria for selection and assessment of applications. The number of PQ companies will be limited based on the target and demand of the programme. The geographical location and coverage area is one of the plus points considered when selecting the companies to participate with programme (Biomass Energy Support Programme 2009).

Pre qualification of metal stove manufacturers are based on the standard criteria which includes the minimum number of available manufacturing equipment, workshop facilities, human resource capacity, and strategic location. The criteria also include the legal documents such as government registration, tax and income papers. All the documents and information provided will be verified. Either the central staff from AEPC/ESAP or regional staff will visit the company and verify the information present in the application. The final selected PQ companies are notified and agreement takes place between AEPC/ESAP and PQ companies which acts as a legal document (Biomass Energy Support Programme 2009).

STEP 2: Subsidy Delivery Mechanism

- Manufacturers are provided with subsidy application forms. Users can contact manufacturer's to seek the subsidized product (Biomass Energy Support Programme 2009).

- It is the responsibility of manufacturers to generate the demand first and then the manufacturers conduct sale/distribution/installation works of the Improved Metallic Stoves with subsidy from the Government of Nepal while remaining within the given terms and conditions. It should follow the manufacturing guidelines and design approved by BESP. In the case of exceptional circumstances (changing design to suit the specific local environment), it should seek approval from the program first.

- If the company failed to comply with the terms mentioned, the company shall be required to pay compensation pursuant to Compensation Recovery Procedure as determined by BESP or it may expel the Company from participation in the program at any time (Biomass Energy Support Programme 2009).

The major terms and conditions for manufacturers include:

(a) The Company shall be required to compulsorily put the engraved number on top of the Improved Metallic Stove sold for the unique identification of each stove. This is for the monitoring purpose so as to make sure that subsidy is being utilized properly.

(b) While selling the stoves by the Company, the stoves should be sold only to the households of V.D.Cs (Village Development Committees) situated at a height of 2000 meters or above or to the households north facing of the V.D.Cs situated at a height of 1500 meters or above. As the primary purpose of metallic stoves is for cooking and space heating in cold areas, it is not suitable in areas below 1500m in altitude where it will overheat and dry the air inside the kitchen.

(c) After sale and installation of Improved Metallic Stoves, the Company shall be required to provide the after sale service to the costumer as specified by the BESP. For the purpose of ensuring that after sale service is effective, the rural Energy Fund (REF) shall, while making payment of the subsidy amount to the Company, deduct 10 percent of the subsidy amount and such deducted 10% amount shall be paid to the Company one year after the completion of the installation.

(d) The Manufacturer/Installer Company shall be required to monitor the stoves installed by it at least twice in the year during the period of after sales service.

(Biomass Energy Support Programme 2009)

- The VDC chairperson/secretary has to verify the user details and recommend that the person is eligible to get benefits from the government subsidy program. The user details include name, detail address, national identification number, eligibility, gender etc.

- Afterwards, the manufacturers who installed stoves will keep installation details in the subsidy application form. The details include the name of the installer person, the representative company, the engraved product identification number, the date of installation including manufacturing costs and the amount paid by the users.

- The filled subsidy application form is then taken to the district Development Office (D.D.C) where authorised government officers in the District Energy and Environment Unit/Section (DEEU/DEEU) will verify installation details.

- RRESC will facilitate the process and check the subsidy application form came via manufactures for national database entry. The biomass Officers of RRESCs are the persons responsible for the given task. Manufacturers have to bring the subsidy application form to the AEPC/ESAP central office.

- BESP will recommend in Memo type after verification of the hard copy of subsidy applications in line with the electronic copy filled by RREESC.

- REF will disburse subsidy amount (datewise) after the verification of hardcopy and electronic copy. REF will disburse subsidy in favour of users to Manufacturers deducting 10% as an after sales guarantee.

The government is responsible for arranging the necessary training for the enhancement of the capability of the Company. It helps to stimulate the demand by itself or with assistance of RRESCs and DEES/U and make arrangement to conduct awareness programs, dissemination of information and educational materials (posters, pamphlet, brochure, and operation of radio program).

(Biomass Energy Support Programme 2009)

STEP 3: Quality Assurance

Quality Assurance is done by random sampling tests of the installed product which is generally 10% of the disseminated numbers.

Chapter Four: Survey Details

4.1. Design of Survey Questionnaire

The main aim of the survey was to collect the information from the field about the effectiveness of the subsidy program. With the limited resources, the author tried to analyse collected data from the users and other beneficiaries to know the current status of the program. The different section and subsections have been designed to gather the information that helps to build the basis to reflect on the effectiveness of the program within the given parameters.

The instruments used in the survey were:

- Direct interviews
- Emails

The survey questionnaire consists of six pages. It has been divided into three main sections and six subsections.

The first section (refer to table 4) consists of the basic information about the interview. This includes name, date, and place of the interview. It is designed to collect information of the family background. It asks for vital information such as educational background and occupation.

Table 4: Basic Family Information

Identifying Household Location:

Name of Village / VDC/Ward No.	
Household Number	
Date of Interview	...../……./……. Time: (a.m./p.m.)
Name of interviewee	

Family information background

Q. No	Questions	Answer
1.	Age	
2.	Sex	
3.	Educational Status	
4.	Primary occupation	
5.	Secondary occupation	

6.	Number of family member	
7.	Family type	
8.	Monthly/Annual income of the family (Rs.)	

(Gender)	**(Educational status)**	**(Occupation)**	**(Religion)**	**(Family type)**
1=Male, 2=Female	A=Illiterate B= Literate 1-9=School, 10=SLC, 12= HSS, 14= BSc, 16= MSc 17=Phd	1=Agriculture, 2=Business 3=Worker, 4=Porter 5=Teacher, 6=Student 7=Private job, 8=Govt. job 9= Tourist guide, 10=Others	1=Hindus 2=Buddhist 3=Muslim 4=Christian 5=Others	1=Single 2=Joint

The second section entitled "Energy and Technologies" has six subsections.

The first subsection (refer to table 5) asks for information on the types of energy resources used in households or at the commercial level. The users had to select three options with priority subjected to availability.

Table 5: Types and uses of Fuel

ENERGY and TECHNOLOGIES

Types & Uses of Household/Business Fuel

Using the fuel list below, what types of fuel do you use for the following purposes? (List in order of importance using numbers shown below)		
Wood =1 Dung = 2 Agricultural residues = 3 Other residues = 4	Charcoal = 5 Kerosene (Paraffin) = 6 Bottled gas (LPG) = 7 Solar cooker = 8 Solar electric (solar PV) = 9	Grid electricity = 10 Batteries = 11 Wax candle = 12 Pico Hydro = 13 Water Mill (IWM/TWM)
If 'other' fuel used, please specify fuel		

Purpose	Fuel Priority		
	Most important fuel	Second Priority	Third priority
Cooking (including drinks)			
Lighting			
Keeping warm			
Heating water for other			

purposes			
Cooking food/drink for selling			
Cooking animal feed			
Electrical equipment			
Other tasks (specify below)			
If fuel is used for another type of household task, please specify task (s)	Task 1: Task 2:		

The second subsection (refer to table 6) collected information on the availability of fuel, the sources of fuel wood and time/distance for the collection of firewood.

Table 6: Getting Fuel wood

Getting Fuel: Buying And Gathering	
Is your main fuel gathered or bought? 1- all gathered 3- mostly bought 2- mostly gathered 4- all bought	
If you gather fuel, please mention:	
Source of gathering	
Distance from home (in hour)	
If you buy it, how much do you pay for it per month?	NRs.
Wood	
Charcoal	
Kerosene (paraffin)	
Bottled gas	
Grid electricity	
Batteries	
Wax candles	
Others	
Total (in NRs.)	
What are the reasons for buying fuel? (more than one reason can be selected) 1. Scarcity of fuel for gathering 2. Faster than gathering it 3. Cleaner for cooking 4. Other reason (please specify)	
If you or your family gather fuel, how often is it gathered? 1- every week 2- every month 3- Twice in a year 4- Specific time(mention)	

If you or your family gather it, about how long, on average, does each collection trip take at this time of year?	……./…….(hrs/mins.)	
If you gather fuel, for how much period, it will be sufficient	……(months)	
If you gather fuel, do you experience any problems when gathering it? If any, write the problems?		

The third subsection (refer to table 7) requires details about the energy resources utilized by hotels and businesses, including the electrical energy consuming appliances.

Table 7: Energy resources in hotel/business

Hotel And Business (optinal)	
Types of energy sed • Fuelwood • Charcoal • Grid Electricity • Solar Energy (PV/Water Heater) • Micro hydro • If any other specify	
List the electrical energy consuming material(s)	
I.	Wattage consumed (if possible)
II.	
III.	
IV.	
V.	
VI.	
VII.	
Total	
Is it sufficient for them	
How much are they paying for energy per year	Yes/No
Any other information regarding this, include point wise,	

The fourth subsection (refer to table 8) is designed to collect information on improved cooking stoves, biomass technology. It includes details about the stove technology with date

of installation. This section is again divided further into technical, economical and maintenance parts.

Table 8: Improved Cook Stove

IMPROVED COOKING STOVES
System Description

Stoves

Type of stove • Shielded mud fire or mud stove (including chimney stove) • Wood-burning ceramic stove (made of fired clay) • Metal stove • Improved charcoal stove • Other type of stove	
Smoke Extraction	Chimney/Smoke hood/Extraction

Installed Date	

Economical

Capital cost of system	
User's contribution	
Government contribution	
• Direct Subsidy	
• Indirect subsidy (government bodies like VDC, DDC)	
• Others	
Affordability in absence of subsidy	

Maintenance

Fault in system components (time after installation in months)	
• Water tank	
• Stove body	
• Others	
No. of maintenance visit	
Any other costs paid by users	

Users' comments (benefits/un-satisfaction)

……

……
……

The fifth and sixth subsections (refer to table 9) are designed to collect the same level of information about solar and micro hydro technologies as the fourth section.

Table 9: Solar PV and Hydropower technologies

SOLAR PHOTOVOLTAIC

System Description

Installer company	
Installed Date	
PV system size in Watt	
Battery bank capacity in Wh	
Light gloves type (WLEDs/ CFL/Incandescent)	
Power used (Watt)	

Economical

Capital cost of system	
User's contribution	
Government contribution	
• Direct Subsidy	
• Indirect subsidy (government bodies like VDC, DDC)	
• Others	
Affordability in absence of subsidy	

Maintenance

Fault in system components (time after installation in months)	
• Battery	
• Charge Controller/Inverter	
• Lights	
• Others	
No. of Maintenance visit	
Any other costs paid by users	

Users' comments (benefits/un-satisfaction)

……
……
……

MICRO HYDRO POWER

System Description

Installer company	
Installed Date	
MHP Capacity	
Power being generated	
Load factor	

Economical

Capital cost	
User's contribution	
Government contribution	
• Direct Subsidy	
• Indirect subsidy (government bodies like VDC, DDC)	
• Others	
Affordability in absence of subsidy	

Maintenance

Fault in system components (time after installation in months)	
• Generator	
• Electronic Load Controller	
• Turbine	
• Others	
No. of Maintenance visit	
Any other costs paid by users	
Operating cost (Human resource)	
Operating cost (Others)	

Users' comments (benefits/un-satisfaction)

……
……

The third section (refer to table 10) of the questionnaire is designed to collect the information from private manufacturers/supplier of RETs regarding their business. It also tried to see the subsidy flow system from their point of view.

Table 10: Manufactures' Detail

MANUFACTURERS/SUPPLIERS/INSTALLERS

i. Total number of system installed per year

Year	No of systems	Capacity (Watt)	District	No of systems	Capacity (Watt)
1997			2003		
1998			2004		
1999			2005		
2000			2006		
2001			2007		
2002			2008		
			2009		

ii. Institutional Arrangement and Human Resources

Year	No of technical staffs	No of non technical administrative staffs	Labor	Total	Remarks
1997					
1998					
1999					
2000					
2001					
2002					
2003					
2004					
2005					
2006					
2007					
2008					
2009					

iii. Profit margin per system/project

……
……

iv. Investment of company in this sector for commercialization of technologies

……
……

v. Market in absence of subsidy

……
……

vi. Support expected from government

……
……

vii. System Manufacturing/Selling

Components	Remarks	Local Manufactured/Imported
SOLAR		
Solar PV		
Battery		
Charge Controller		
Inverter		
Cables		
Lights		
Others		
MICRO HYDRO		
Turbines		
Pipes		
Generators		
Others		
BIOMASS		
Stoves		
Raw materials		

viii. Time flow chart for Subsidy channelizing process (in days) (included in appendix)

ix. Manufactures any comments (in relation to current subsidy delivery mechanism and possible improvements)

……
……

Lastly, the fourth section (refer to table 8) is targeting management level staff. It is in the form of a direct interview with some of the key personnel of the organizations where they were asked about SWOT (Strength, Weakness, Opportunity and Threat) of subsidy programs and probability of RETs market without continuation of subsidy.

MANAGEMENT STAFFS (including POLICY MAKERS)

This includes management level staffs including policy makers at Ministry.

i. SWOT(Strength, Weakness, Opportunities and Threat) Analysis of the program in relation to increasing:
   - Affordability
   - Accessibility
   - Employment (Institutional/Commercial Capacity)

ii. RETs Market in absence of subsidized program\
It should see the policy in relation to
   - Ease to administer
   - Ease to implement
   - Fairness and efficient

At the end table 11 outlines the importance of designing each section of the survey questionnaire to extract the required data which acts as input variables to research and analyse the effectiveness of the program.

Table 11: Validation of Survey Questionnaire

Section	Input variables to research
1	Family background information essential to see the level of education of respondents and their financial status. This will show their awareness of the technology as well as their ability to afford it.
2	Provides information on the types of energy technologies being used. This will help to analyse the energy supply and demand scenario in that area.
3.1	This will help to calculate the time value of using the conventional technologies.
3.2	Energy details of commercial sector shows their interest to adapt new

	technologies and hence shows affordability and viability of the RETs.
3.3 and 3.4	Technology wise data can help to show the current status of the subsidy program in terms of affordability, government contribution and level of awareness among the user group. This will give a direct indication of the effectiveness of the subsidy program from the user's perspective. The reliability of the technology and private players' contribution can be analysed from these sections.
4	Provides information on the subsidy program from the eyes of private suppliers. This will help to analyse the timing of subsidy, as this determines the market value of the product as well.
5	Management level views and suggestions

Chapter Five: Analysis of an effectiveness of the subsidy programme

The subsidy program can be seen as providing a benefit to both the supply and the demand side. The subsidy receivers, the RETs users, are at the demand side and enjoy government support to increase their living standard. This is always considered as a perfect tool to highlight the government's presence in the country. But it can be viewed from another angle; one of the more controversial points of such a subsidy is that political parties use this as a means to maintain their image or gain support from the public to remain in government (UNEP 2008).

On the supply side, the subsidy program aims to increase the number of private bodies in the RETs market, making it more competitive and commercial in the long run. This is considered to be an essential factor for the sustainable development, as the subsidy cannot be continued forever, especially in developing countries where the government has to rely on foreign donors, including multi-lateral and bilateral organizations. Also, this type of donor driven subsidy program is more tailor-made, controlled by donors on specific implementation modality and guidelines which may lead to more bureaucratic systems. Different implementation modalities for the same RETs, all operating within AEPC umbrella, are one good example to demonstrate this point. Though all are targeted for the rural impoverished communities, it creates confusion for the users and all related players involved This research aims to analyse ESAP subsidy program based on the following parameters:

- Targets and Achievements
- Impact of RETs
- Subsidy Delivery System Efficiency
- Transparency
- Sustainability
- Effectiveness

The next section will describe each parameter in detail.

5.1. Targets Vs Achievements

This is the basic parameter to measure the progress of any program. The quantitative analysis needs to differentiate between the two ESAP operational periods- Phase I and Phase II. The data has been extracted from the ESAP administrative official document as referenced in

table 12 (ESAP 200, 12). It shows the status of ESAP Phase I and II based on technologies which are Improved Cookstoves (ICS), Micro Hydro Power (MHP), and Solar PV home systems. Considering the two programs with subsidy, MHP has achieved 102% of the target and SHS has reached 155% of the target whereas ICS has achieved an outstanding 222% of the given targets as shown in table 1 below. The following table clearly shows the total coverage of the programs at the village and district level. MHP covers the mountainous areas with 169 VDCs in 38 districts with a total of 33000 households (HHs) beneficiaries. The sector has created 2997 jobs with 54 pre-qualified companies. Similarly, SHS benefited 69,524 HHs covering 72 districts out of total 75 districts. The overall achievement of the Phase I program is successful as it has created thousands of jobs, almost 100 private companies, hundreds of service centres, few local consultants and hundreds of local partner organizations. This can be considered to be a good beginning in the subsidized sector.

Table 12: ESAP 1 Status

ESAP 1 – Status as of June 2006	ICS (HHs)	MHP (kW)	SHS (HHs)
Target (2000-2006)	90,000	2,850	45,000
Achievement	200,000	2,914	69,524
Remarks	222% of the target	102% of the target	155% of the target
Reached VDCs	711	169	1855
Reached districts	34	38	73
Reached households	200,000	33,000	69,524
Employment implications	>2,500	2997 (1230 full time, 1767 part time)	>1,500
Companies working in the sector	-	54 qualified	30 (15 qualified)
Branches and service centres	9	4	350

Local consultants	-	40	10
Local Partner Organizations 1) NGOs, 2) Local Government, 3) Companies/agents	125 [1)]	196	350 [3)]

(ESAP 2006)

ESAP Phase II started in March 2007 for 5 years till March 2012. The progress of the program as of November 2010 is shown in table 2 and table 3 below:

Table 13: ESAP 2 Status as of November 2010

	Revised Target June 2010	Achievement (70% of way through Phase II period)	Remarks
Biomass Energy Support Programme (in Units)			
Mud ICS	305,000	191,020	63% of the target has been achieved (The only program with no direct subsidy)
Metallic ICS	17,000	3,500	20% of the target
Institutional Stoves	2,800	354	13% of the target
Institutional Gasifiers	55	1	2% of the target
Household Gasifiers	500	27	5% of the target
Solar Energy Support Programme (in Units)			
Solar Home System (SHS)	215,000	157,000	73% of the target
Small SHS	100,000	9,000	9% of the target

Solar PV Pumping	100	0	0% of the target
Mini Grid Support Programme			
MHP Commissioned (kW)	13,700	2,468	18% of the target

(NORAD 2011)

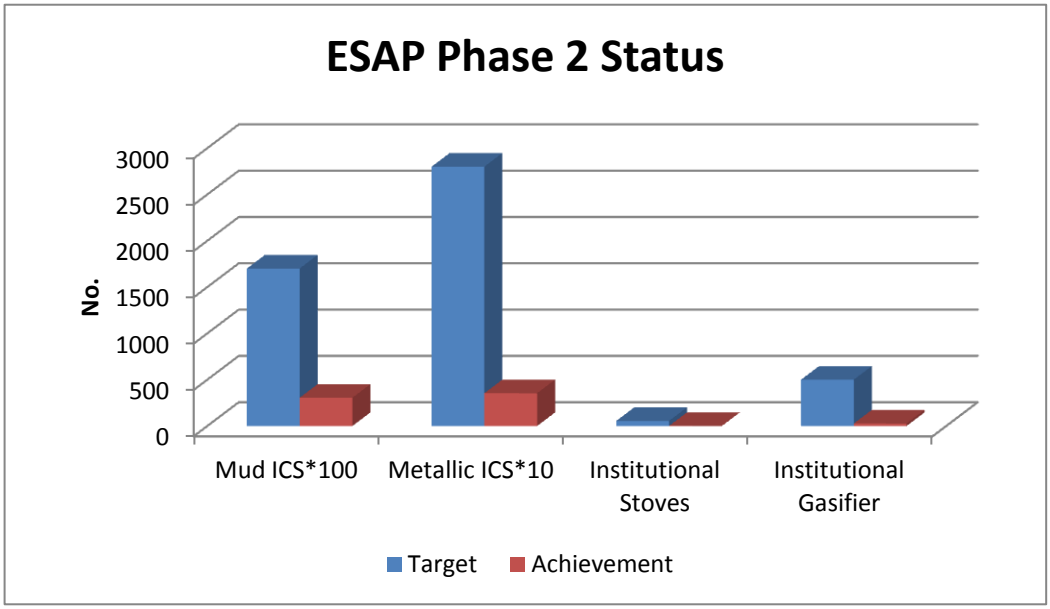


Figure 10: Status of BESP/ESAP Phase II as of November 2010

(NORAD 2011)

Biomass Energy Support Programme

70% of the way through the Phase II period, the dissemination of the metallic stoves in high altitude areas has not even achieved one quarter of its target even though the target has been revised from 50,000 to 17,000. The major reason is the finalization of the subsidy delivery modality for the dissemination purpose. The delivery modality was only finalized in mid 2009, whereas the subsidy had already been allocated in 2007. The author was the primarily person responsible for finalizing the delivery modality at that time and achieved the goal within 10 months. Hence, delay in launching the program was the primary reason for the poor result shown above. The survey questionnaire involving metal stove manufacturers revealed that slow processing of the subsidy application form is another reason for the low number of stoves installed.

Solar Energy Support Programme

The solar Home system program seems to be right on track, as it has already achieved 73% of the total target with one still one and a half years to run. This system is considered to be one of the favourite systems which are also proved by the high user demand and its target achievement, whereas the small solar home system program is yet to achieve even one tenth of its target. The survey revealed that the reason behind this involves the lengthy and bureaucratic subsidy application process which is elaborated more in the next section. The suppliers revealed that the low profit margin in SSHS is another reason for investors' unwillingness in system dissemination even though the program is said to be demand driven.

Mini Grid Support Programme

Though almost 5 MW of MHPs is currently under construction, the programme has achieved just 18% of the target to date. The main factor causing this is the economic status of the villagers. Though MHP is considered to be a cheap power generation option compared with solar, the capital investment is high for the whole plant. As the subsidy covers only 50%, the local user committee is responsible for managing the remaining fund. Banks are yet to invest in MHPs with confidence in the absence of insurance and also because of very low load factors achieved, because of low end user activities. Increasing the cost of fuel, materials and equipment are other factors contributing to the slow progress of the programme.

The installation trends for SHSs and MHPs are shown below. The installation numbers are low in bridging period for both technologies.

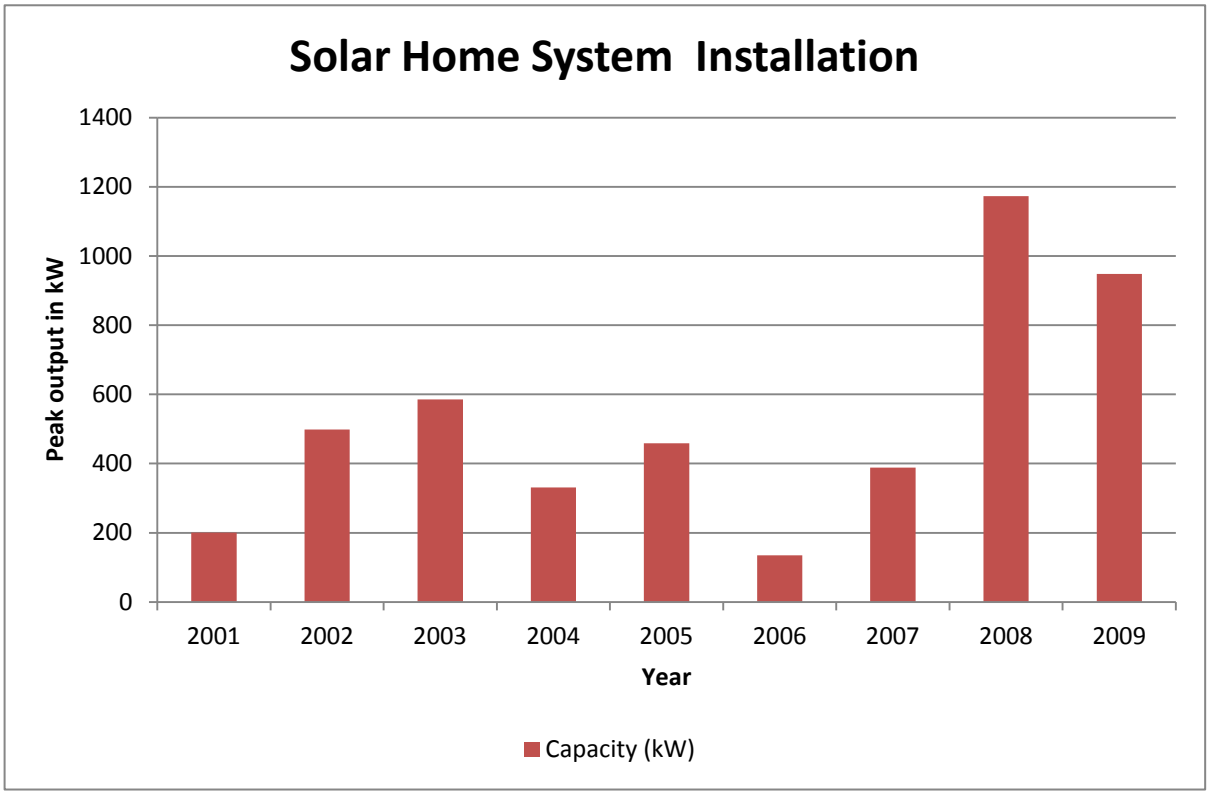


Figure 11: Solar Home System Installation Trend

(ESAP 2010)

Figure 11 shows the SHS installation registered good growth in the first three years followed by a downward trend for the following four years. The market again recovered in 2007 with more subsidy funds becoming available (Survey 2010/11).

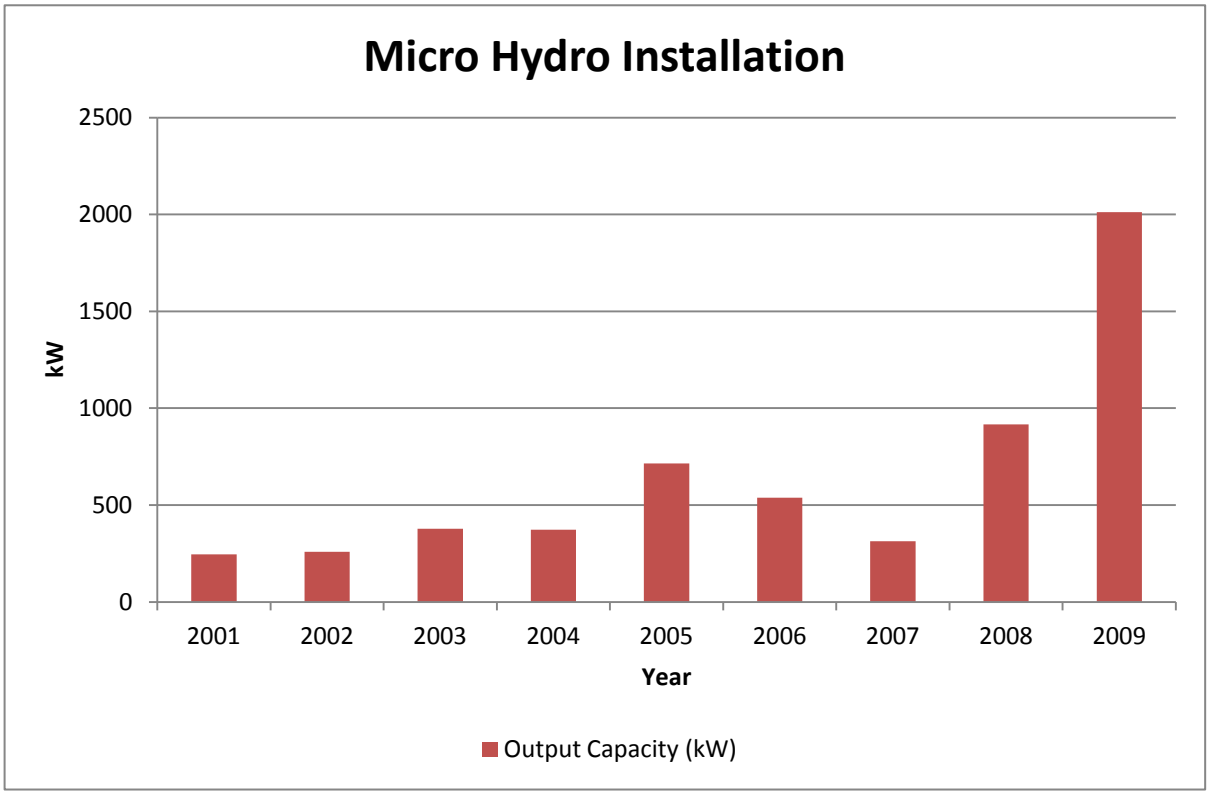


Figure 12: Micro Hydro Power Installation Trend

Installation of MHP saw a steady growth from 2001 till 2005, and then a small downward trend can be seen during bridging period due to reduced fund availability. Since 2008, installation rate increased significantly as can be seen in figure 12 above. The government policy started to emphasizing rural decentralized energy supply systems is considered to be one of the main reasons for this trend.

5.2. Impact of RETs

No baseline study has been conducted prior to the implementation of the programme. As stated in one Australian government document, "A Baseline Study gathers key information early in an Activity so that later judgments can be made about the quality and development results achieved of the Activity"(AusAID 2003,3). This is indeed quite necessary for developing an effective monitoring and evaluation plan of the programme. Although a brief study had been conducted just to establish realistic targets for the programme, the absence of a detailed baseline study has limited the data available on the impact of RETs on communities.

The survey questionnaire asked the RETs users about the impact of these RETs technologies on their lives. The general benefits from technologies were listed as improved health and

hygiene due to less pollution in the kitchen, enhanced visibility, and a better environment for children to study, less pressure on the environment due to a reduction in firewood consumption, increased employment opportunities (end user activities) etc. The random sampling method used in this research collects information directly from users and the results are tabulated as follows. The category has been divided into education, health, economic condition on a priority basis. Table 14 below shows the results. Interestingly, the survey revealed that people are now more conscious of their children's education as the importance of education is being realized by the many parents (Survey 2010/11).

In case of Metallic Stoves, the people are happy with the health benefits due to the clean smokeless kitchen. Especially the women are very happy with the technology.

The study also reveals that in average, family members can save a minimum of 15 minutes per day for fuel wood gathering due to improved cook stoves (Survey 2010/11). Hence, these results in the direct and indirect financial benefit.

According to the survey, Solar Home System was quite popular among the children as they provide the good visibility to study rather than the conventional "Tuki (Kerosene powered cotton lump/lantern)" or "Jharro". The economic and health benefits falls in second and third preference.

In case of Micro Hydro, the response is same as of Solar PV system. The end user activities such as agriculture processing etc are resulting good economic benefits in some of the areas.

Table 14: Impact of RETs

Technology	Priority		
	1	2	3
Metallic stoves	Health	Economic	Education
Solar Home System	Education	Economic	Health
Micro Hydro Power	Education	Economic	Health

(Survey 2010/11)

This has been supported by the result (See figure 13) that 75% of respondents fell into the category of illiterate or Under SLC (School Leaving Certificate)/Grade 10 Standard. Illiterate consist of 32% of that. Only 4% of the people went on to University level. Those 50% respondents have agriculture as their first background or general labour work. The remainder are either in the government /teaching/NGOs sector. This shows that subsidy is playing a very supportive role in increasing the literary rate in the country. The time saved in fuel gathering, availability of smokeless kitchen is creating a good environment for students.

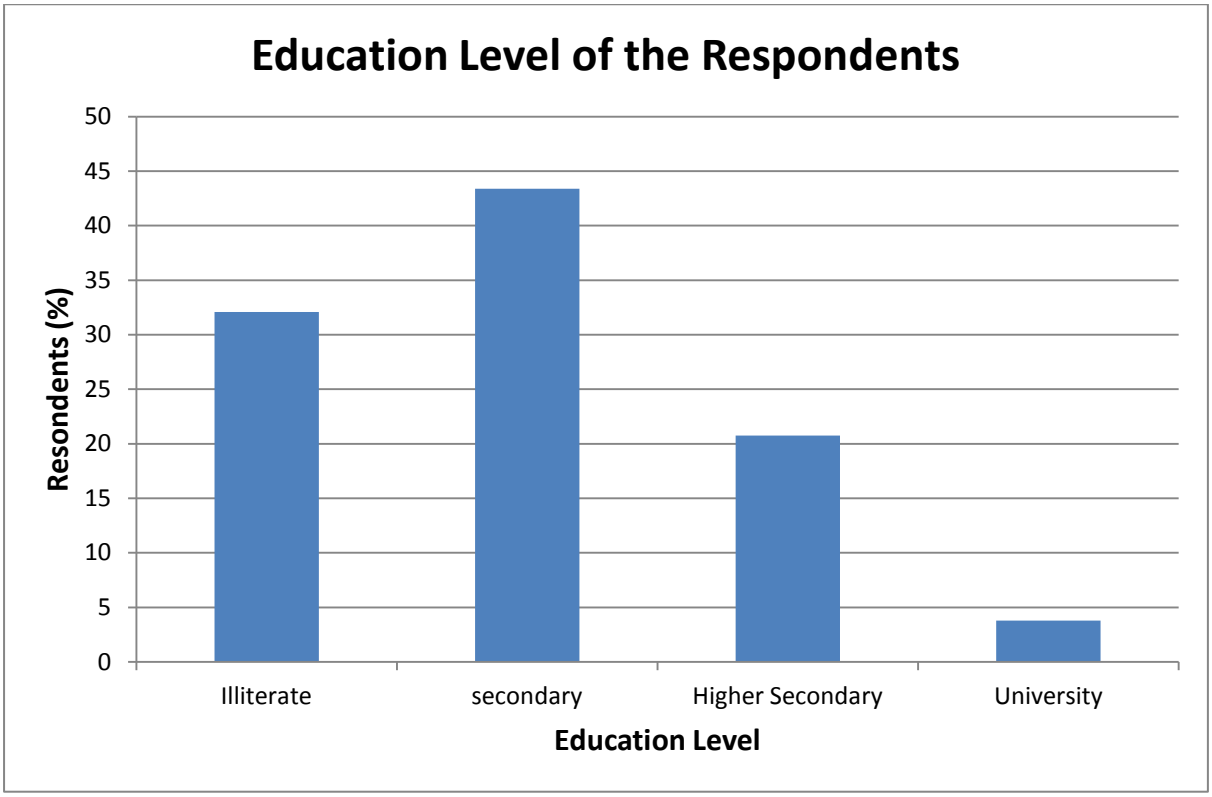


Figure 13: Education Level of Respondents

Another major impact can be seen in the increased access to modern forms of communication and entertainment technologies such as radio, transistor, television and mobile phones. These instruments act as a window for those rural communities to connect to the economically more advanced side of the world. People are getting access to more information, connecting to their relatives abroad, making their life much easier and more comfortable (Survey 2010/11).

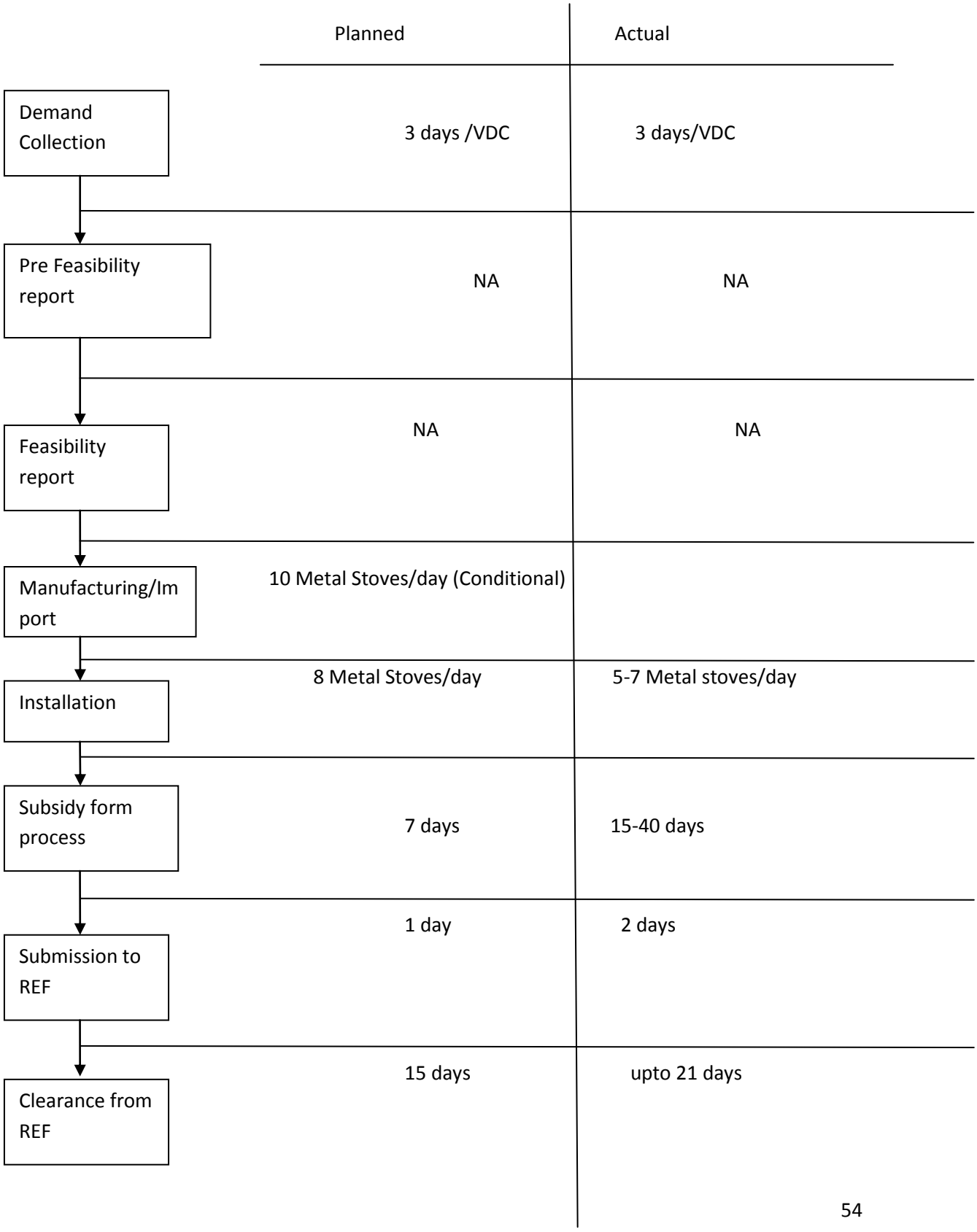
5.3. Subsidy Delivery System Efficiency

The survey revealed that in all cases, the subsidy flow channel is very time demanding. As discussed in the previous chapter, suppliers/manufacturers/installers have to go through

different channels to get the subsidy on behalf of the users. A gross timeline was developed for the subsidy flow based on the feedback provided by manufacturers/installers/suppliers of different RETs. Though this timeline cannot be considered as perfect, it will still give an indication of the operation of the system.

In metallic stoves, the planned and the actual time for the subsidy delivery process has been summarized as follows based on the interviews taken with five pre-qualified metal stove manufacturers from different zones. The table 15 shows the steps of subsidy delivery mechanisms.

Table 15: Subsidy Delivery Processing Time for Metallic Stoves



SUBSIDY APPLICATION PROCESS

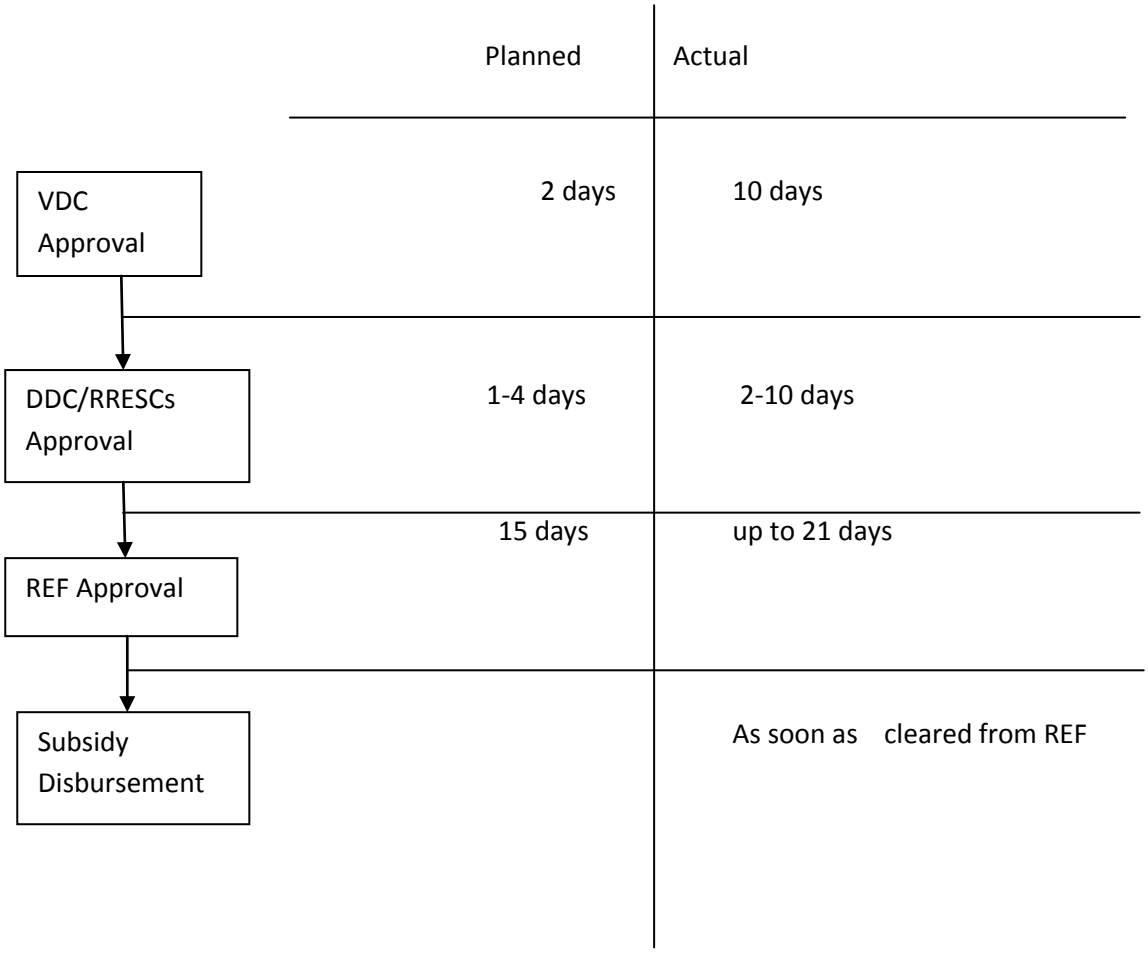


Table 15 above shows that the actual time is at least one month longer than the planned time. The major reason behind this is the unavailability of VDC secretaries for the users' verification for subsidy eligibility. All the local government authorities such as VDCs, DDCs and municipalities remain without elected representatives since July 2002 when the government at that time dissolved all elected councils (Acharya 2011). This led to a void in the local councils and hence the government civil servants acting as the secretariat in those councils were actually overloaded with all their responsibilities with authority which includes "administration of the VDC allocated budget for basic services and development projects; registration of births, deaths and marriages, management of voter lists, tax collection, citizenship certification, property transfers, subsidy verification etc" (OCHA Nepal 2010, 1). OCHA Nepal's survey showed that due to the people's war and other political instability, only 42% of VDC Secretaries are active in their VDCs, whereas 25% of those were stationed in district headquarters, 14% are partially active and the remaining positions were vacant.

Some VDC Secretaries are handling more than one VDC. This is where most of the time is being wasted.

DDC's approval time and then RRESCs data entry procedure adds another significant time delay in the process as they may not be in the same geographical area, although staff are available most of the time unless they are in the field.

Interest Rate

Taking all these time delays into consideration, investment were almost frozen for that period of time added by 10% after sales service guarantee. The current lender interest rate in Nepal is 15% per annum on average (NIBL 2011). Ultimately, users will be bearing these time laps cost as private investors included this also into their administrative expenses. Tables 16 and 17 show the subsidy delivery process for SHS and MHP respectively.

Table 16: Subsidy Delivery Processing Time for SHS

	Solar		Remarks
	Planned	Real	
Demand collection	3 months	3 months	
Pre-feasibility Report	NA	NA	
Detail Feasibility Report	NA	NA	
Manufacturing/Import	45 days	50-55 days	
Installation	7 days	10 days	
Subsidy Form Process	2 months	4-6 months	This includes VDC approval, DDC approval and submission to Programme/REF and Subsidy disbursement

(Survey 2010/11)

The case is almost the same as that of metallic stoves, except this process is lengthier as they need photo documentation.

Table 17: Subsidy Delivery Processing Time for MHP

	Micro hydro		Remarks
	Planned	Real	
Demand collection	On demand		
Pre-feasibility Report	1 month		
Detail Feasibility Report	1-3 months		
Manufacturing/Import	3 months	5-6 months	

Installation	3 months	6 months - 1 year	
Subsidy Form Process	1-2 months	3-5 months	Depends on documentation and matching fund availability

(Survey 2010/11)

In the case of MHP, the main reason for the delay is the inability of the local committee to find the matching funds of the remaining 50% of the project after subsidy, and hence will be seeking other sources of funding. This will increase the project lead time. The other reasons are lower number of companies in the sector, brain drain problems, migration of skilled manpower as skilled workers are attracted to more highly paid jobs abroad (NMS 2011).

Another problem for delays as described in the NORAD (2011) report is the dual contract approach of ESAP. The first contract relates to electro-mechanical components of MHP and is signed by the turbine manufacturer/installer company and the users' committee. The second contract concerns civil contract work which is carried out by the community itself. The time mismanagement between the two contractors can delay the project as the installer has to wait for the civil work to be completed. This, in turn again holds the subsidy instalment payment from REF, increasing the cost of the project as discussed above in the interest rate section.

5.4. Transparency

Transparency International has ranked Nepal at 146 out of 178 countries scoring just 2.2 out of 10 on the scale in the Corruption Perceptions Index 2010, which measures the level of public sector corruption (Transparency International 2011). In 2008 it was ranked 121 and in 2009 it was 143, showing that the situation in Nepal actually got worse. In contrast, the major donors, Denmark and Norway, were ranked 1st and 10th in 2010. The ESAP subsidy program as a whole is transparent. The management implemented extra features to make sure that subsidy reaches the right people. The subsidy is fixed in all RETs rather than the percentage of the total cost price. Other important features are:

Photo identification along with national identification card is used in SHS subsidy documentation. The company has to submit two photos along with a photocopy of the national identification card (see figure 14) with the subsidy application form. The first photo should include the SHS with background to the home whereas the second photo

should include the recipient as shown in figure 15. The relationship has to be verified if the person in the photo and person on the application form are different. This information will be later on tallied by a monitoring group in the field based on a random sampling basis (Nepal Ministry of Environment 2008, 1-35).

Figure 14: National identification Card Verification

Figure 15: subsidy Receiver with Monitoring Group

(Solar Energy Support Programme 2010)

- There is a company code with unique product identification number engraved in each product of Metallic stoves and SHS.

- All the parts and accessories of RETs have to comply with the government standard or else the service provider company will face a penalty as signed in the contract. The Renewable Energy Test Station (RETS) is the national agency for quality assurance and providing quality compliance to the product based on national standard (RETS 2010).

- There is a provision of dual signature by the executive Director of AEPC and the Chief Advisor of ESAP in all contracts and expenditure documents. The subsidy disbursement is also through the REF subsidy committee which includes ED/AEPC, CA/ESAP, and Accountant from both AEPC and ESAP along with REF programme Manager.

- There is 10% random sampling field monitoring of installed Metallic stoves and SHS with the help of external consultants, field and central staff. In case of MHP, there is 100% monitoring (NORAD 2011).

(Nepal Ministry of Environment 2008, 1-35)

Although the program has taken all these measures, the company profit margin seems to vary as the market is open and free of government intervention. The survey has found two cases in SHS distributed in the same district in 2009 as follows:

Table 18: System with/without subsidy

Power (Watt)	Subsidy	User's contribution
20	Yes	NRs. 12000
20	No	NRs. 13000

(Survey 2010/11)

The above data shows just a difference of NRs. 1000 (around 6% of the capital cost) between the system with subsidy and without subsidy. Though the general coverage is 30% for solar (as shown below in figure 18), almost 24% of the subsidy amount is lost, either due to high subsidy administration cost or high profit margins of the companies.

5.5. Sustainability

This is considered to be an important part of any programme. As already discussed, donor driven subsidies cannot be continued on a long term basis and so the market should grow before the end of the programme. Sustainability here has been defined as the increase in the capacity building on the supply side of the programme so as to sustain continued operation in the respective market without any external aid.

The capacity building activities are:

- Non certified Metallic Stoves Installation Training
- Solar Electrician Level 1 Training course for Installation (Certified by Government agency known as Centre for Technical Education and Vocational Training (CTEVT)

- Solar Electrician Level 2 Training course for Repair and Maintenance (Certified by Government agency known as Centre for Technical Education and Vocational Training (CTEVT)
- Micro Hydro Installer's Training
- Micro Hydro Operator's Training

(NORAD 2011)

The biomass Energy Support Programme is now working with one national and 138 district based NGOs, as well as two Universities. It has already resulted in 15 metallic stoves manufacturing companies. The Solar Energy Support Programme has now 26 qualified solar PV companies for dissemination of SHS and 36 Solar PV companies for the dissemination of SSHS. The number of companies registered for PV has increased from three to 70 over 10 years along with 500 branches. The program has trained around 2500 Solar Electrician Level 1 and 200 Solar Electrician Level 2 certified technicians. The Mini Grid Support Programme has 57 Pre-Qualified Installation/Construction Companies for Improved Water Mills Electrification/Pico/Micro Hydropower Projects and 52 Pre-Qualified Consulting Companies for Survey & Design of the Micro Hydropower Projects: 52 including seven district based NGOs (AEPC 2010).The government is now moving towards credit financing as well. Initiated by AEPC/ESAP, three banks have given loan to 21 rural cooperatives to work to finance solar PV systems.

Although the above data on capacity building activities seems encouraging, this survey (2010/11) reveals migration of these trained human resources is causing problems in these markets. Political instability is considered to be the major cause for this. 98% of the total respondents including users, public and private sectors say that markets will collapse if the subsidy is discontinued. The inability to afford the systems by the community and high cost of the systems are two of the major reasons given for this. Investors are still not confident to invest in this sector as the government cannot support the program on its own and donors are only supporting for a fixed project time.

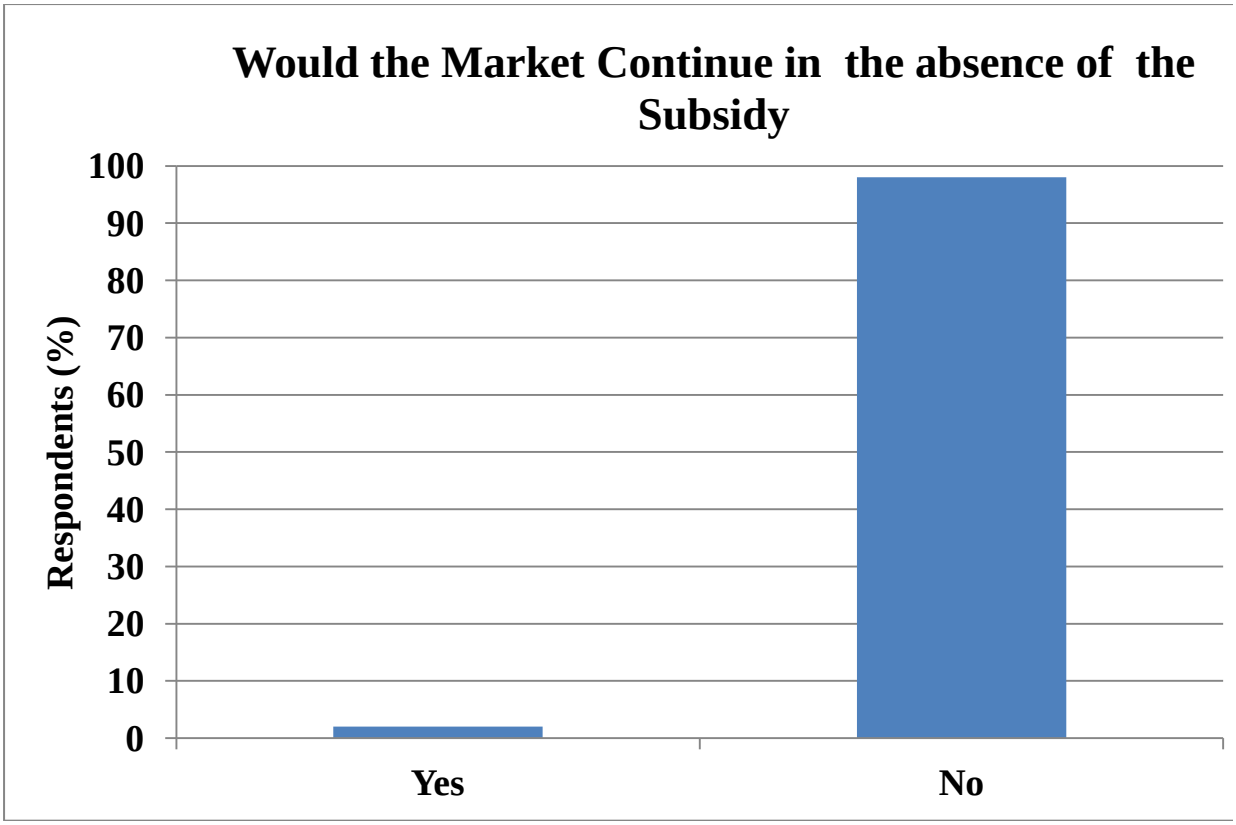


Figure 16: Market continuity in Absence of the Subsidy

(Survey 2010/11)

Figure 16 shows that 98% of the survey respondents are not confident that the market will continue in the absence of the subsidy.

The survey showed that the average income of the respondents is Nepalese Rupees NRs. 110,636 per year (1 AU$ = NRs. 75.52 as of June 14, 2011 (NRB 2011). This does not match with the official data, although the survey has been limited to only a number of families in different parts of the country. The big variation in income relates to the remoteness of the location. The lower the income, the more remote is the location and vice versa. In a country where the average inflation rate was 9.8% over the last three years (NRB 2011), with an average family size of 4.6, the people are very reluctant to expend significant amount of money to buy expensive RETs. Currently, all the RETs users are still using firewood as their primary source of energy for cooking.

This subsidy program is not yet successful in making creating a market, although it has achieved its target of electrifying the rural areas.

Another important part in this case would be to check the reliability of private bodies involved in supplying/installing RETs. In case of Metallic Stoves, the subsidy process is still in its first year so there are no cases of after sales service. As per the contract between the private bodies and AEPC (Biomass Energy Support Programme 2009), in the first year of installation, they have to visit field two times a year to guarantee after sale service. The parts guarantee in case of Solar Home System and Metallic Stoves are upto the users and service providers. The survey has found that almost 25% of the respondents confirmed that the service providers didn't make a single visit and one visit in case of 65% cases as shown in the figure 17 below.

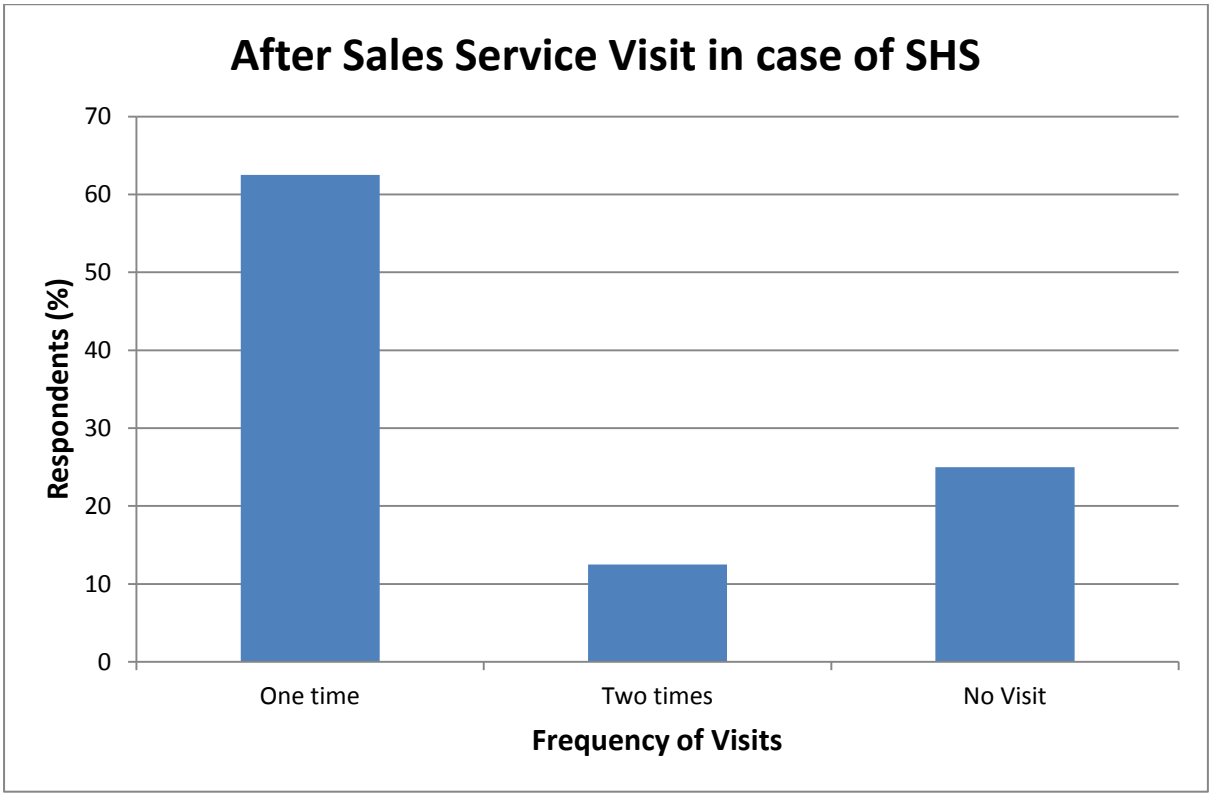


Figure 17: After Sales Service Visit in case of SHS

5.6. Effectiveness

The author defined "Effectiveness" as the subsidy program reaching the poorest communities, addressing the following questions:

- Are the current subsidies making RETs accessible to the poor?
- Progression of subsidy rates over time/is the subsidy policy cost-effective?

The primary data collected from the Rural Energy Fund/ESAP (Survey 2010/11) has shown the following results. Figures 18 and 19 show the portion of subsidy and remaining total investment in the Solar and Micro Hydro sector from 2001 to 2009. Data on Metallic stoves is unavailable as the dissemination program just started in mid 2009.

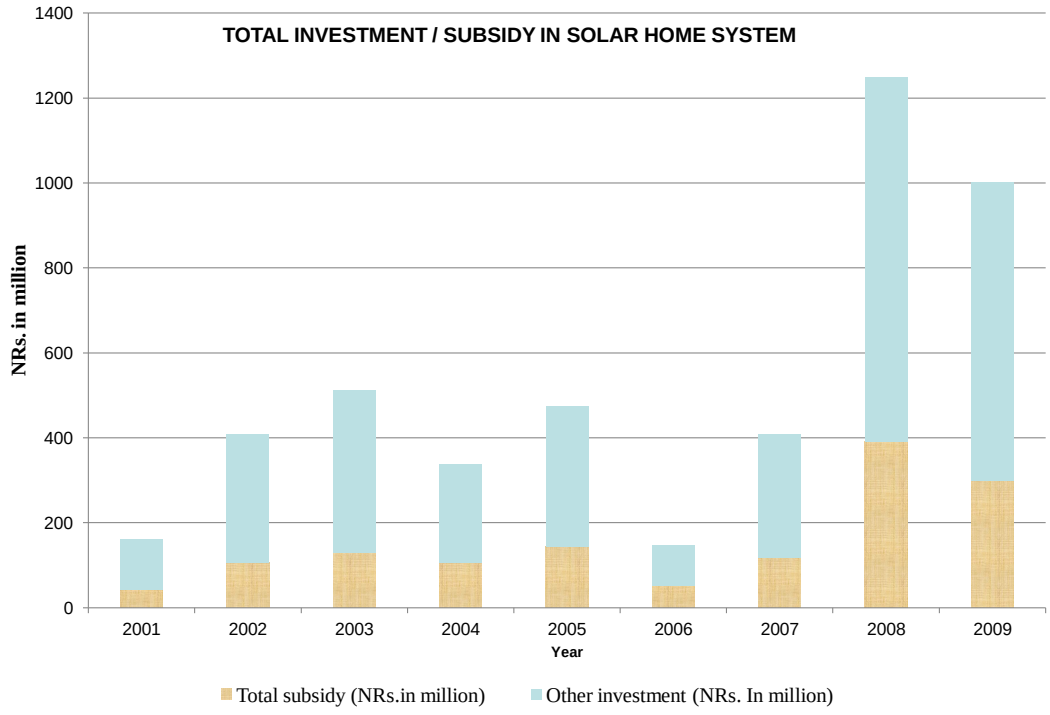


Figure 18: Investment Vs subsidy in SHS

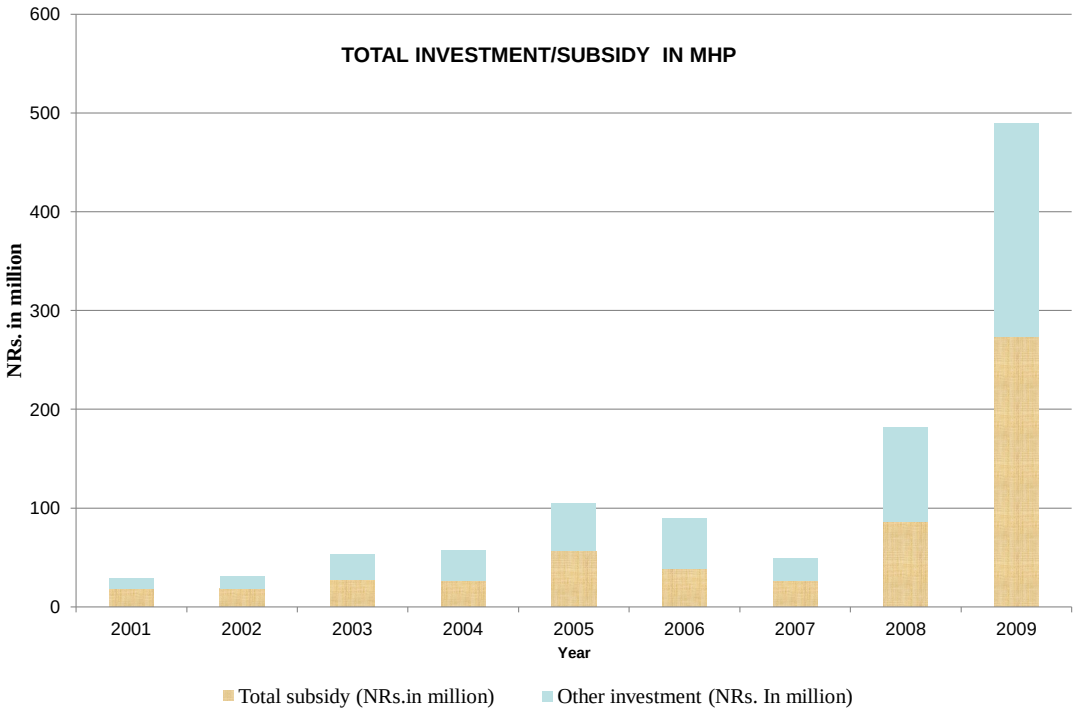


Figure 19: Investment Vs subsidy in MHP

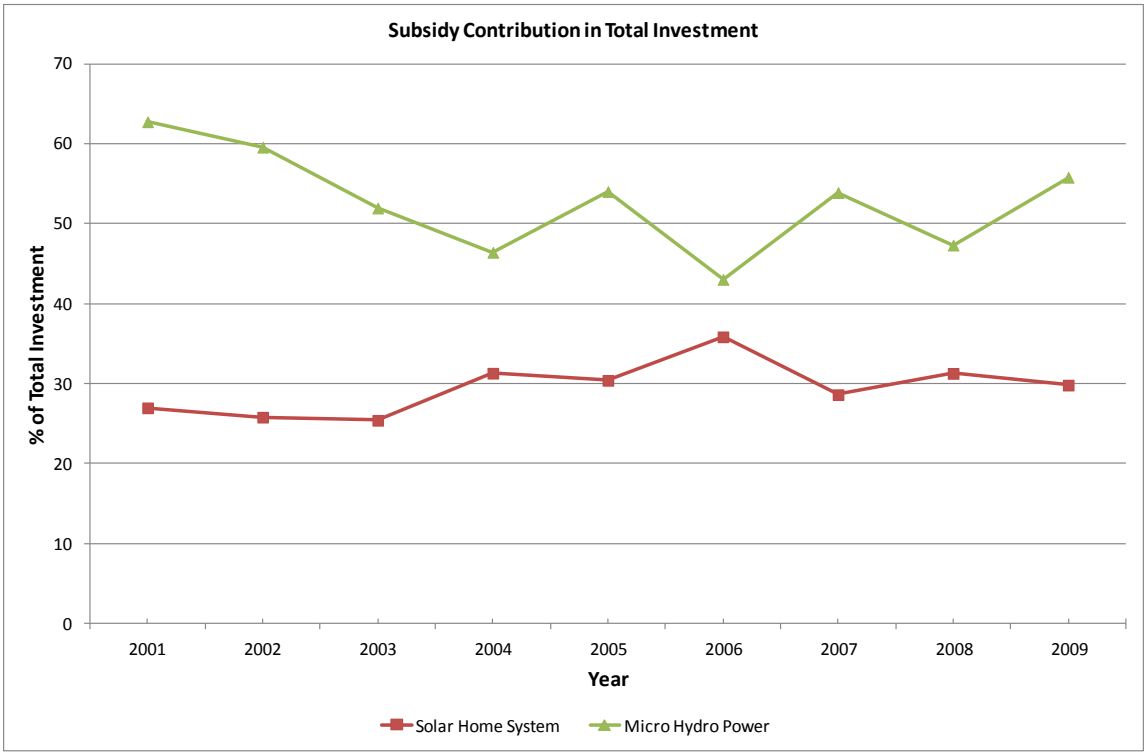


Figure 20: Subsidy as a percentage of total investment

Figure 20 shows the subsidy contribution in the total investment. This represents the total figure. It can be seen that in the case of MHP, it is around 50% on average and around 30% in the case of solar. Currently, the user still has to bear a significant cost to obtain the subsidy.

Metallic Stove: Specific Case Study

In the case of metallic stoves, the survey (Survey 2010/11) showed that subsidy is covering around 50% of the factory price only. The user also has to bear costs for the remaining transportation and installation of the system. That varies with the geographical location. In one location, the user might get by adding an extra 10-20%, whereas it could double in some places like Humla. The author has conducted a specific case study of Metallic Stoves and subsidy contribution in the far western region of Nepal to show the reality of the subsidy program. The following tables 19 and 20 show change in material price of metallic stoves over the years and Subsidy Vs User's contribution change over the time.

Table 19: Change in Material Price of Metallic Stoves over the years

	Year Rate (NRs. Per kg)					
Materials	2006	2007	2008	2009	2010	2011
4mm iron plate	55	58	61	62	65	67
Hot Roll Sheet (16 gauge/1.6 mm)	61	64	67	69	71	75
CGI sheet (26 gauge)	80	85	105	115	120	125
Stainless Steel (26 gauge/1.25 mm)	309	325	350	360	375	400

Source: (Interview with Rijwan Engineering Udhyog, Nepalgunj/ Pre-qualified company)

Table 20: Subsidy Vs User's contribution change over the time

S.N.	Scenario in 2006	Scenario in 2008	2011
1.	Unit cost of model • Weight of stove = 40 kg • Factory Cost = **NRs. 5000**	Unit cost of model • Weight of stove = 40 kg • Factory cost = **NRs. 7345**	Unit cost of model • Weight of stove = 40 kg • Factory cost = **NRs. 7700**
2.	Transportation • Air Transportation charge from Nepalgunj to Simikot, Humla: Rs 75.84/kg*40kg = **NRs. 3034** • Additional local transportation (porter charge) from district headquarter/ airport to village*NRs.50	Transportation • Air Transportation charge: Rs 84.15/kg* 40kg = **NRs. 3366** • Additional local transportation (porter charge) from district headquarter/ airport to village*NRs.80	Transportation • Transportation charge: Rs 130/kg* 40kg = **NRs. 5200** Additional local transportation (porter charge) from district headquarter/ airport to village*NRs.80 Per kg air transportation has increased by almost 67% since 2008 Source: (Interview with staff of Yeti Airlines 2011)
Total cost per unit	NRs 8084	NRs 10791 excluding installation charge	NRs. 12980 excluding installation charge
Increment %	Baseline	33.4%	60.5%
Subsidy Allocation	NRs. 2500	NRs. 4000	NRs. 4000
User's contribution in %	69% of the total cost	63% of total cost	69% of the total cost
Average Per capita income			NRs. 10128 – NRs. 13572/annum
Technology as % of their income		Almost a year's income	More than a year's income

Source: (Survey 2010/11)

The above tables 19 and 20 clearly show the subsidy contribution to the total cost and its evolution over time. In many places, it is almost impossible for the communities to get the subsidized system on their own as it costs them their whole income. The case is even worse

with solar PV systems and MHPs, as per kW cost of the system are much more expensive. (See figure 21).

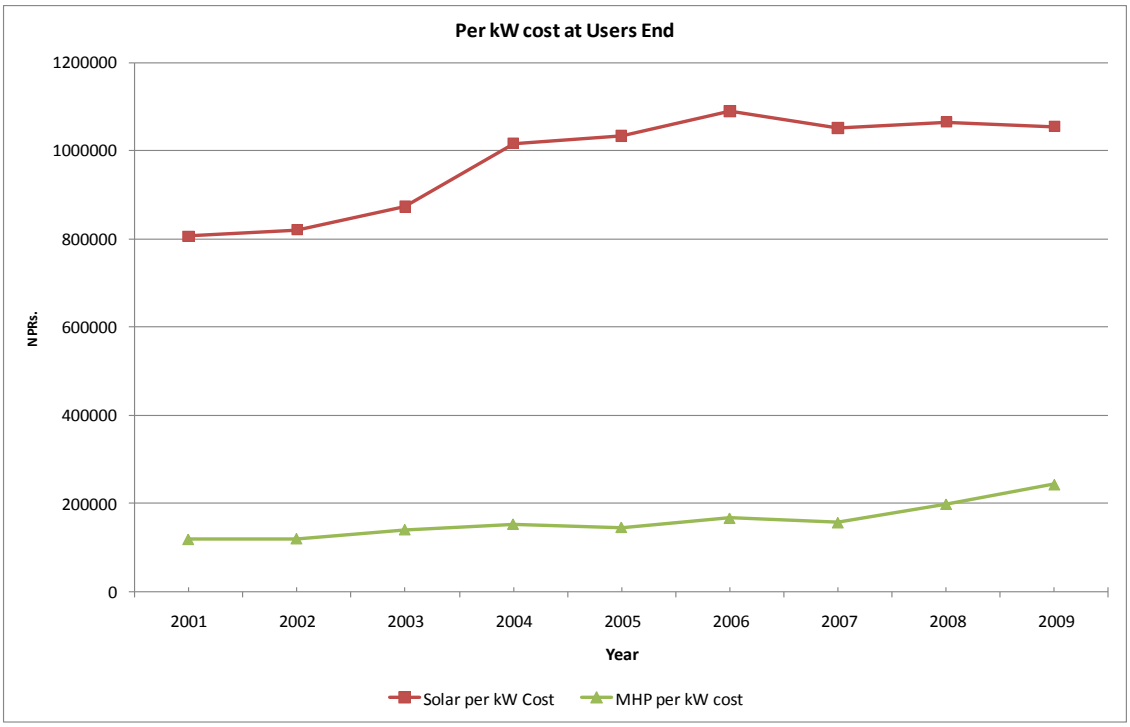


Figure 21: Per kW cost at Users' End

Figure 21 shows per kW cost of MHPs and SHSs in different years. Considering 16 W of a normal SHS costs NRs. 15666, of which the subsidy amounts to just NRs 7000 as of 2011. Users have to still pay NRs. 8666 per system. Also, considering 100Watt contribution from one user/HH which is the general case for MHP, the cost is NRs. 16058. Even though the subsidy covers 50%, they have to bear the remaining fund which is still considerable for those poor people. Furthermore, this is only the average cost, and it can vary significantly due to transportation and installation based on different geographical location.

Chapter Six: Conclusion and Recommendation

6.1. Conclusion and Recommendation Overall, the ESAP program has achieved its goal to reach the rural areas providing energy through renewable energy technologies. The subsidy program can be considered as a successful program in terms of its dissemination number in ESAP Phase I and phase II. The government subsidy programme through the Rural Energy Fund is heading in the right direction with some adjustments recommended in its delivery mechanism.

The positive impacts of RETs can be seen in the livelihoods of the users particularly in terms of increasing awareness on health and education. Another major benefit can be seen in the communication sector. Small television, radio and mobile sets are the results of this modern access to energy. The subsidy program creates a niche market for the RETs suppliers, manufacturers and installers and giving confidence to them. The market has grown rapidly over the last ten years, although the confidence levels of the investors are still below the marked line for the market to be sustainable, once the subsidy program is not continued. The increase in the number of private bodies and office staff as discussed in section 5.5 on "sustainability" of chapter five.

There are currently different donor organizations in the renewable energy sector with different implementation modalities under the AEPC umbrella. The government and its partners should work towards the implementation of the program with its single best modality.

The ESAP has taken enough measures to make the whole subsidy delivery system transparent by taking different measures including photo identification and the introduction of a legal contract system with the private companies.

With reference to RETs, the subsidy amount needs to be revised and adjusted in Metallic Stoves, based on the geographical location and remoteness of the region as supported by the case study details. The flat subsidy rate is not serving effectively due to the variation in transportation costs throughout the country. In the case of MHP, the end user activities need to be encouraged to increase the load factor and hence the productivity of the system. The government has to play a strong role in enhancing the credit mechanism system for hydro and solar projects. The banks and the insurance companies should be brought in the market. This completely depends on the government providing clear policies and assurance to the market.

Although the subsidized program is successful in electrifying the rural communities via RETs, the poorest of the poor families are still excluded from the subsidy. The program seems to benefiting more the rich and upper middle class families rather than the poor families for which the subsidy was intended. The high capital cost and long subsidy delivery process are the main important reasons for this failure. The author has proposed a new modality which might overcome the time barriers and bureaucratic process in the subsidy delivery mechanism and will decrease the lead time. This will in turn help to reduce the operational cost of the private companies and will encourage more players to enter the market increase competition and resulting in lower system costs.

The recommended subsidy delivery modality is described below (see figure 19).

Renewable Energy Service Contractors (RESC)

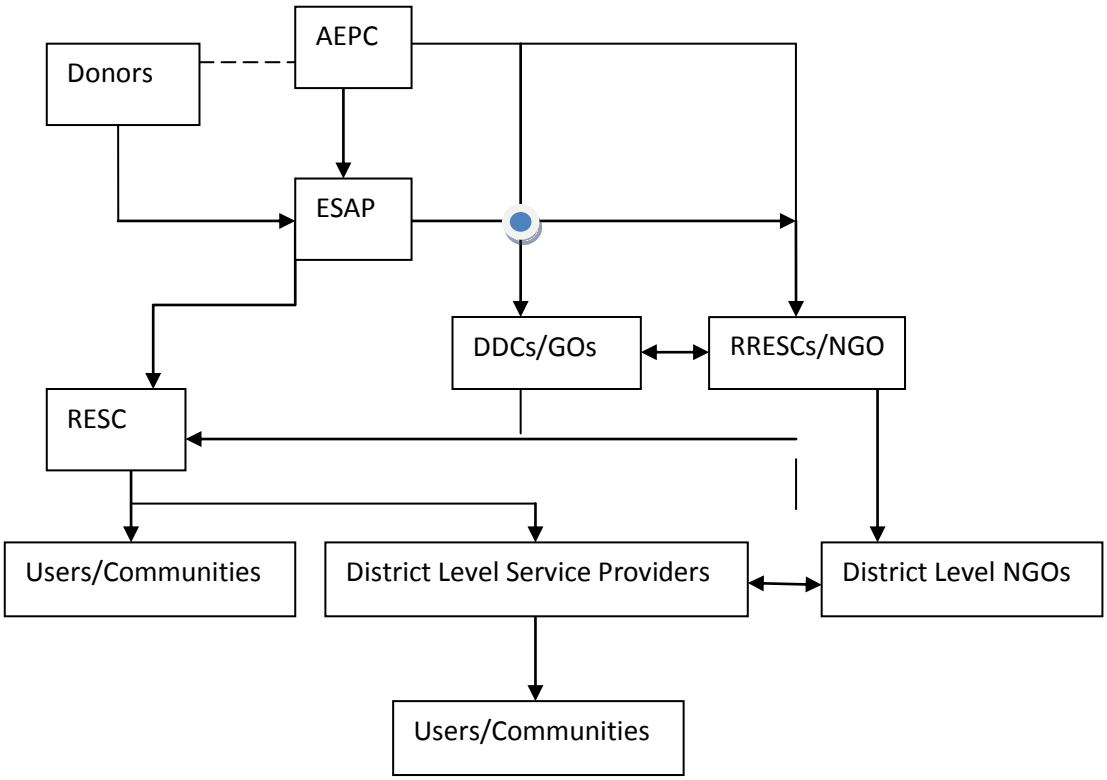


Figure 22: New Working modality incorporating Renewable Energy Service Contractors

The new modality consists of a layer (see figure 22) in between manufacturers/suppliers and users known as Renewable Energy Service Contractors (RESC). It is a purely private body investing in the RE sector with the aim of making profit. In the short term, its function is to ease the subsidy application process and hence make the subsidy delivery modality more effective and efficient. In the medium term, it starts to build a solid foundation for commercial dissemination of the technologies. The long term target is to create a niche market for RETs, without having to rely on external support or subsidy.

Who will fund?

The donors will give a soft loan to the RESC with a government guarantee repay the loan. The RESC must contribute a minimum of 40% of the total investment of the project proposal. The loan amount should be based on assessing the capacity of the organization based on the proposal submitted by the organization. The first loan should be for a minimum of five years, with the first two years being an interest holiday or zero interest and the last three years being

as grace period, with minimal interest. This concept has been based on the Bangladeshi Solar PV electrification project as described in the literature review in chapter two.

Formation of RESC

The RESC should be established on a regional basis. The government has to conduct stakeholder meetings to decide the basic selection criteria for the region formation and number of RESC in the beginning. This should be based on the availability of resources and population rather than the current administrative division. The current qualified companies will be given the first opportunity to form the RESC within or outside of their respective region.

Some of the criteria should be:

- Local companies' investment should not be less than 51%.
- 50% of the staff should be from the local area. This has two main advantages. First, it results in trust by the user's committee in the organization, and second, it makes us of local human resources, increasing the stability of the workforce. Experience has shown that outside people are less likely to remain in the workforce and more likely to look for outside opportunities.

Features:

The concept of this new modality of Renewable Energy Service Contractors (RESC) incorporates two major benefits over previous subsidy delivery modality. They are as follows:

- The need of VDCs and DDCs recommendation has been removed as the responsibility is transferred to the RESC.
- The responsibility of the RRESCs/NGOs has been slashed and the RESC is responsible for maintaining the database. The NGOs will help the RESC to create demand and assist in the information/awareness campaign.

These two features will save the significant time and hence reduce the major administrative cost of subsidy.

Additional advantages would be as follows:

- They will introduce the concept of micro financing credit via rural cooperatives and microfinance companies.

- The amount of subsidy has to decrease on a fixed percentage within five years and the donor support should be diverted to create a platform for industrial growth. This modality is more focussed on developing the private sector and encouraging entrepreneurs in this sector. In the long run, it will be helpful for the government to start a decentralized district energy funding concept as described in the ESAP programme document (ESAP 2006). Within a fixed period of time when the donors are more convinced of the system, the government can plan to disburse the subsidy from the respective district known as the District Energy Fund.

Roles and Responsibilities:

Table 21 briefly describes the roles and responsibilities of all organizations involved in this sector. Table 22 below shows the subsidy flow process with the new modality and the responsible organizations. In comparison to the existing modality, it definitely saves a significant amount of processing time; thus being not only more efficient, but more sustainable as well.

Table 21: Roles and Responsibilities in new modality

Alternative Energy Promotion Centre (AEPC)	• Policy and plan formulation • Liaise with Ministry and donors • Quality Assurance • Liaise with donors and private bodies
Energy Sector Assistance Programme (ESAP)	• Technical Assistance particularly more on industry development such as establishing Solar battery manufacturing plant, turbine and generator development etc. • Loan Sanction Selection Committee for RESC • Implement Awareness and Information Campaign through RRESCs with the support from DDCs

	• Institutional Capacity development
Regional Renewable Energy Service Centres (RRESCs)	• Non Government bodies responsible for awareness campaign and information dissemination along with their other programmes such as health and hygiene, income generation activities etc
District Development Committee (DDCs): DEES/DEEUs	• Coordinate the energy activities in the district with the support of RRESCs and other stakeholders • Monitor and support Renewable Energy service Contractors (RESC) • Quality Assurance of the projects
Renewable Energy service Contractors (RESC)	• Private body with the aim of aiming to generate profit in the renewable energy sector • Commercialize RETs • Work with manufacturers/suppliers for the dissemination of projects. In the long run, it has to act as a supplier as well. • Will give more space to manufacturers to focus on manufacturing business, allowing them to have more time for R&D • Will deal with subsidy application form • Responsible for maintaining database and will be legally liable for its work • Work with DDCs, RRESCs for demand collection and awareness campaign • Work with district based rural cooperatives for small capital RETs and handle bigger scale by itself • More focus on concept of institutional Solar PV system, Grid Feed in system, Mini Grid system , electrification through gasification

	• Acts as service centres for RETs in the respective area with qualified technicians • Student Internship opportunities (Field and Theory based)

Table 22: Subsidy Delivery Mechanism

Work Flow	Responsible Organization
Information and Awareness Campaign	RESC, RRESCs, DDCs, district level NGOs/GOs
Demand collection	RESC, RRESCs, DDCs, district level NGOs/GOs
Subsidy Application Form Filling for Users	RESC (Verification based on Citizenship Card)
RETs Supply and Installation	RESC via Manufactures/Supplier
After Sales Service	RESC via Manufactures/Supplier
Maintaining Database	RESC
Submission of application form to REF	RESC
Fund Disbursement to Manufacturers	REF (AEPC/ESAP)
Monitoring and Quality Assurance	AEPC/ESAP with DDCs

Integrated Services to Community

The subsidy program can deliver integrated services with RETs to the community. As all components (Solar, Biomass and Micro Hydro) of the program are running independently from each other and also from other government programs in different sectors, such as health, water, sanitation etc., there is a need to implement these technologies integrated with other development projects to get the best result. The example can be taken from the work of one NGO known as Rural Integrated Development Services -Nepal (RIDS-Nepal). RIDS-Nepal is a non-Government organization working in one of the rural communities in Nepal (Zahnd 2011). According to its project director, Alex Zahnd (2011), RIDS-Nepal has developed the concept of a holistic approach to community development which is focussed on a comprehensive approach rather than being a project specific selective approach. The organization works on the concept of "Family of Four" and "Family of four plus" integrated with RETs such as Solar PV, thermal, pico hydro and biomass fired improved cook stoves. The Family of four includes the following:

- "A pit latrine for improved hygiene/health
- A smokeless stove inside the house for cooking/room heating/hot water

- Basic electric indoor lighting and
- Access to clean drinking water" (Zahnd 2012, p2).

These projects are implemented in the first instance to support the basic living needs of the impoverished people. After these projects have been implemented, the family of four plus projects are introduced, consisting of the following:

- "Greenhouse for high-altitude villages
- Non-Formal-Education (NFE) classes for mothers and out-of-school children
- High-Altitude Solar Water Heating (HASWH) bathing centre
- Solar Cooker for cooking during the day
- Solar drier to dry vegetables, fruits, meat etc. for winter and income generation
- Slow Sand Water Filter (SSWF)
- Nutrition program for malnourished children <5-years of age" (Zahnd 2012).

The aim of all these projects is to raise the living standard of the target communities and to make the project more sustainable in the long run. The combined effect of all these projects is much more than it is for individual projects working separately in the same area. This saves the project money and time, reducing the administrative expenses.

Overall, the research project has fulfilled its given objectives as stated in chapter one. The government has to play the major role in streamlining the RETs sector and subsidy delivery modality. The market has to be more competitive and fair in order to ensure that the users are being directly benefited by the subsidy program. The research has evaluated the effectiveness of the subsidy program with the limited number of sample size. The sample size has to increase and further works as described in section 6.2 is needed to examine the program in much effective way. The research concluded that the effective and practical policies need to be placed to increase the impact of the subsidy program benefiting both users and private bodies.

6.2. Further Research

Further research is required in the following areas:

- The recommended modality of “Renewable Energy Service Contractors” can be studied in more detail to know its advantages and disadvantages in much more detail.
- A comparative study of different implementation modalities of the different programs under the same umbrella of AEPC will yield the pros and cons of all modalities. The result will be helpful in preparing a common implementation modality for the subsidized program, making the system delivery much effective and efficient.
- A study can be conducted to see the subsidy delivery timeline in detail, taking considerable sample size.
- A detailed study on the credit enhancement in the subsidized RETs program is recommended and this requires the involvement of the financial sector to ensure the sustainability of the RETs market.

References

1. Acharya, A. 2011. "A Decade of Democratic Deficit." *Nepali Times*. May 13-May 19. http://nepalitimes.com/issue/2011/05/13/ByTheWay/18193 (accessed July 24, 2011).

2. ADB. 2011. *Economic trends and prospects in developing Asia: South Asia.* http://www.adb.org/documents/books/ado/2011/ado2011-nep.pdf (accessed March 1, 2011).

3. AEPC. 2010. *Rural Energy Policy*. http://www.aepc.gov.np/index.php?option=com_content&view=category&layout=blog&id=87&Itemid=116. (accessed October 15, 2010).

4. AEPC. 2010a. *AEPC Homepage*. http://www.aepc.gov.np/. (accessed September 11, 2010).

5. AEPC .2010b. *AEPC: Introduction & Working Modality*. Lalitpur: AEPC.

6. AEPC .2011. *AEPC Annual Progress Report 2010*. Volume 1. Lalitpur: AEPC

7. AusAID.2003. *Baseline Study Guides.* http://www.ausaid.gov.au/publications/pdf/baseline_guidelines.pdf (accessed July 24, 2011).
8. Author Experience.2009. Team Member of Biofuel Technical Committee. Kathmandu: AEPC.

9. Banerjee, Sudeshna G., A.S. Hussain, and A. Samad. 2011. *Power and People: The Benefits of Renewable Energy in Nepal*. Washington: World Bank. http://www.esmap.org/esmap/sites/esmap.org/files/RenewableEnergy_ESMAP_Nepal_7-12-11.pdf (accessed July 2, 2011).

10. Bangladesh. Ministry of Power, Energy and Mineral Resources.2011. *Bangladesh's Power Sector: At a Glance*. http://www.powerdivision.gov.bd/index.php?page_id=262 (accessed August 11, 2011).

11. Bangladesh. Ministry of Power, Energy and Mineral Resources.2008. Renewable Energy Policy of Bangladesh. http://www.powerdivision.gov.bd/images/additional_images/REP_English.pdf (accessed September 21, 2011).

12. Biomass Energy Support Programme. 2009. Metallic Stoves Subsidy Delivery Modality. Lalitpur: AEPC.

13. Biomass Energy Support Programme/ESAP. *2001-2011 Field Photo Collection*. Lalitpur: AEPC.

14. CIA. 2010. *The World Factbook: Nepal*. https://www.cia.gov/library/publications/the-world-factbook/geos/np.html (accessed August 1, 2010).

15. Currency Converter.2011.*Tranzfers*. http://www.currencyconverter.com.au/ (accessed November 10, 2010).

16. ESAP.2010. *ESAP MIS Database*.Lalitpur:AEPC

17. ESAP .2006. ESAP Phase II- Programme Document**:** Lalitpur: AEPC.

18. ESAP.2011. *Analytical Study on Subsidy Rates for Rural Renewable Energy Technologies & their Delivery Mechanism*. Lalitpur: AEPC.

19. Foundation Nepal.2011.*Income Levels and Malnutrition in Humla*. http://www.foundation-nepal.org/content/income-levels-and-malnutrition-humla (accessed June 20, 2011).

20. Grameen Shakti.2011.*Solar PV Program: Financing Solar Home Systems*. http://www.gshakti.org/index.php?option=com_content&view=article&id=66&Itemid=62 (accessed May 15, 2011).

21. IDCOL.2010. IDCOL Solar Energy Program. http://www.idcol.org/Download/IDCOL%20Solar%20Energy%20Program.pdf (accessed September 21, 2010).

22. IEA. 2010. *Selected 2007 Indicators for Nepal*. http://www.iea.org/stats/indicators.asp?COUNTRY_CODE=NP (accessed April 1, 2010).

23. IEA.2011. *International Small-Hydro Atlas: Nepal*. http://www.small-hydro.com/index.cfm?fuseaction=welcome.home (accessed January 28, 2011).

24. Juggle. 2010. Nepal: Topographic Map of Nepal. http://advocacynet.org/blogs/media/users/nicole/Nepal_map_topography.jpg (accessed August 2, 2010).

25. Nepal. CBS. 2011. National Population and Housing Census 2011. Kathmandu: Central Bureau of Statistics

26. Nepal. Ministry of Energy. 2010. *Policy*. http://www.moen.gov.np/policy.php (accessed September 13, 2010).

27. Nepal. Ministry of Environment.2006.*Rural Energy Policy 2006*. http://www.aepc.gov.np/images/pdf/RE-Policy-2006.pdf (accessed September 13, 2010).

28. Nepal Ministry of Environment.2008. *Renewable (Rural) Energy Subsidy Mechanism, 2066*. http://www.aepc.gov.np/images/pdf/resdm2011.pdf (accessed September 10, 2011).

29. Nepal. Ministry of Forest and Soil Conservation. 2010. *Forest Law and Master Plan*. http://www.mfsc.gov.np/upload/downloads.htm (accessed March 13, 2010).

30. Nepal. Ministry of Science and Technology.2010. *Policies, Acts & Regulations*. http://www.most.gov.np/np/index.php?option=com_content&view=article&id=70&Itemid=58&lang=en (accessed September 13, 2010).

31. Nepal. National Planning Commission.2008. *About Us: Introduction.* http://www.npc.gov.np/uploads/plans/20110902104225.pdf (accessed July 14, 2010).

32. Nepal. Ministry of Finance.2011. *Economic Survey FY 2008 – 2009: Energy and Forestry.* http://www.adb.org/documents/books/ado/2011/ado2011-nep.pdf (accessed July 14, 2011).

33. Nepal. Ministry of Finance.2011. *Economic Survey FY 2010 – 2011:* http://www.mof.gov.np/publication/budget/2011/surveyeng.php (accessed July 14, 2011).

34. Nepal. National Planning Commission.2008. *Three Year Interim plan.* http://www.npc.gov.np/uploads/plans/20110902104225.pdf (accessed July 14, 2010).

35. NIBL. 2011. *Interest Rates*. http://www.nibl.com.np/index.php?option=com_content&view=article&id=48&Itemid=32 (accessed August 13, 2011).

36. NMS .2011. "Brain drain major educational problem: Prime Minister Bhattarai." *Nepal Mountain News*. November 7. http://www.nepalmountainnews.com/cms/?p=41988 (accessed November 7, 2011).

37. NORAD. 2011. Joint Review of Energy Sector Assistance Programme (ESAP II). http://um.dk/da/~/media/UM/Danish-site/Documents/Danida/Det-goer-vi/Miljoe/WMESAP%20II%20Joint%20Rev%C3%ADewfinal.ashx (accessed July 24, 2011).

38. NRB.2011. *Foreign Exchange Rates*. http://www.nrb.org.np/fxmexchangerate.php?YY=2011&MM=06&DD=14&B1=Go (accessed June 14, 2011).

39. OCHA Nepal. 2010. *VDC Secretary Presence in Nepal*. http://www.internal-displacement.org/8025708F004CE90B/(httpDocuments)/B8B7E489B28D274DC12576EE0031A2D3/$file/2010-03-22-VDC-Secretary-Notes.pdf (accessed December 24, 2010).

40. Rajbanshi, K. J. 2002. *Zoo-geographical distribution and the status of coldwater fish in Nepal*. Volume 364 DOI: Food and Agriculture Organization. United Nations http://www.fao.org/docrep/005/y3994e/y3994e0r.htm (accessed November 16, 2010).

41. Rijan, Kamal., and N.K. Bansal.2000. *Profiting from Sunshine*. Kathmandu: ICIMOD. http://books.icimod.org/uploads/ftp/Profiting%20from%20sunshine.pdf (accessed August 1, 2010).

42. RETS. 2010. *Welcome to RETS*. http://www.retsnepal.org/ (accessed September 10, 2011).

43. Solar Energy Support Programme/ESAP. *2001-2011 Field Photo Collection*. Lalitpur: AEPC.

44. SWERA. 2010. *Meteorology: Map of Nepal selected meteorological stations and elevation from NREL*. http://swera.unep.net/index.php?id=metainfo&rowid=223&metaid=342 (accessed September 16, 2010).

45. Survey 2010/11. Field Visit Report 2010-2011 for Thesis work entitled *Evaluation and Analysis of Impact of Subsidies on Small Scale Renewable Energy Technologies Dissemination: A Case Study of Nepal.* (Author: Pandey, Rojan Kumar)

46. Transparency International.2011. *Corruption Perceptions Index*. http://www.transparency.org/policy_research/surveys_indices/cpi/2010 (accessed November 7, 2011).

47. UNEP. 2008. *The Impact of Energy Studies: Reforming Energy Subsidies*. http://www.unep.org/pdf/pressreleases/reforming_energy_subsidies.pdf (accessed October 15, 2010).

48. UNHCR.2001. Administrative Map of Nepal. http://www.unhcr.org/3c2357144.html (accessed October 10, 2010).

49. Urmee, Tania.2009.Solar PV Electrification Programs in developing Countries: Towards an Holistic Approach. Murdoch: Murdoch University.

50. WECS. 2011. *Energy Synopsis Report 2010*. Kathmandu: Water and Energy Commission Secretariat. http://www.wec.gov.np/noticefile/test_1309074425.pdf (accessed July 27, 2011).

51. WEPA. 2010. *Nepal: State of Water Resources*. http://www.wepa-db.net/policies/state/nepal/state.htm (accessed November 16, 2010).

52. Zahnd, A. 2010. *Light*. http://www.rids-nepal.org/index.php/Light.html (accessed December 10, 2010).

53. Zahnd A., 2012. "The Role of Renewable Energy Technology in Holistic Community Development." PhD diss., Murdoch University.

Appendix

I. Survey Questionnaire

BASIC INFORMATION

1. Identifying Household Location:

Name of Village / VDC/Ward No.	
Household Number	
Date of Interview	...../……./……. Time: (a.m./p.m.)
Name of interviewee	

2. Family information background

Q. No	Questions	Answer
9.	Age	
10.	Sex	
11.	Educational Status	
12.	Primary occupation	
13.	Secondary occupation	
14.	Number of family member	
15.	Family type	
16.	Monthly/Annual income of the family (Rs.)	

(Gender)	**(Educational status)**	**(Occupation)**	**(Religion)**	**(Family type)**
1=Male, 2=Female	A=Illiterate B= Literate 1-9=School, 10=SLC, 12= HSS, 14= BSc, 16= MSc 17=Phd	1=Agriculture, 2=Business 3=Worker, 4=Porter 5=Teacher, 6=Student 7=Private job, 8=Govt. job 9= Tourist guide, 10=Others	1=Hindus 2=Buddhist 3=Muslim 4=Christian 5=Others	1=Single 2=Joint

ENERGY and TECHNOLOGIES

1. Types & Uses of Household/Business Fuel

Using the fuel list below, what types of fuel do you use for the following purposes? (List in order of importance using numbers shown below)		
Wood =1 Dung = 2 Agricultural residues = 3 Other residues = 4	Charcoal = 5 Kerosene (Paraffin) = 6 Bottled gas (LPG) = 7 Solar cooker = 8 Solar electric (solar PV) = 9	Grid electricity = 10 Batteries = 11 Wax candle = 12 Pico Hydro = 13 Water Mill (IWM/TWM)
If 'other' fuel used, please specify fuel		

Purpose	Fuel Priority		
	Most important fuel	Second Priority	Third priority
Cooking (including drinks)			
Lighting			
Keeping warm			
Heating water for other purposes			
Cooking food/drink for selling			
Cooking animal feed			
Electrical equipment			
Other tasks (specify below)			
If fuel is used for another type of household task, please specify task (s)	Task 1: Task 2:		

1. Getting Fuel: Buying And Gathering

Is your main fuel gathered or bought? 1- all gathered 3- mostly bought 2- mostly gathered 4- all bought	
If you gather fuel, please mention:	
Source of gathering	
Distance from home (in hour)	
If you buy it, how much do you pay for it per month?	NRs.
Wood	
Charcoal	
Kerosene (paraffin)	
Bottled gas	
Grid electricity	
Batteries	
Wax candles	
Others	
Total (in NRs.)	
What are the reasons for buying fuel? (more than one reason can be selected) 1. Scarcity of fuel for gathering 2. Faster than gathering it 3. Cleaner for cooking 4. Other reason (please specify)	
If you or your family gather fuel, how often is it gathered? 1- every week 2- every month 3- Twice in a year 4- Specific time(mention)	
If you or your family gather it, about how long, on average, does each collection trip take at this time of year?	……./…….(hrs/mins.)
If you gather fuel, for how much period, it will be sufficient	……(months)
If you gather fuel, do you experience any problems when gathering it? If any, write the problems?	

2. Hotel And Business (optional)

Types of energy Used • Fuelwood • Charcoal • Grid Electricity • Solar Energy (PV/Water Heater) • Micro hydro • If any other specify	
List the electrical energy consuming material(s)	
VIII.	Wattage consumed (if possible)
IX.	
X.	
XI.	
XII.	
XIII.	
XIV.	
Total	
Is it sufficient for them	
How much are they paying for energy per year	Yes/No
Any other information regarding this, include point wise,	

3. IMPROVED COOKING STOVES

System Description

Stoves

Type of stove • Shielded mud fire or mud stove (including chimney stove) • Wood-burning ceramic stove (made of fired clay) • Metal stove • Improved charcoal stove • Other type of stove	
Smoke Extraction	Chimney/Smoke hood/Extraction
Installed Date	

Economical

Capital cost of system	
User's contribution	
Government contribution	
• Direct Subsidy	
• Indirect subsidy (government bodies like VDC, DDC)	
• Others	
Affordability in absence of subsidy	

Maintenance

Fault in system components (time after installation in months)	
• Water tank	
• Stove body	
• Others	
No. of Maintenance visit	
Any other costs paid by users	

Users' comments (benefits/un-satisfaction)

4. SOLAR PHOTOVOLTAIC

System Description

Installer company	
Installed Date	
PV system size in Watt	
Battery bank capacity in Wh	
Light gloves type (WLEDs/ CFL/Incandescent)	
Power used (Watt)	

Economical

Capital cost of system	
User's contribution	
Government contribution	
• Direct Subsidy	
• Indirect subsidy (government bodies like VDC, DDC)	
• Others	
Affordability in absence of subsidy	

Maintenance

Fault in system components (time after installation in months)	
• Battery	
• Charge Controller/Inverter	
• Lights	
• Others	
No. of Maintenance visit	
Any other costs paid by users	

Users' comments (benefits/un-satisfaction)

……

……

……

5. **MICRO HYDRO POWER**

System Description

Installer company	
Installed Date	
MHP Capacity	
Power being generated	
Load factor	

Economical

Capital cost	
User's contribution	
Government contribution	
• Direct Subsidy	
• Indirect subsidy (government bodies like VDC, DDC)	
• Others	
Affordability in absence of subsidy	

Maintenance

Fault in system components (time after installation in months)	
• Generator	
• Electronic Load Controller	
• Turbine	
• Others	
No. of Maintenance visit	
Any other costs paid by users	
Operating cost (Human resource)	
Operating cost (Others)	

Users' comments (benefits/un-satisfaction)

MANUFACTURERS/SUPPLIERS/INSTALLERS

x. Total number of system installed per year

Year	No of systems	Capacity (Watt)	District	No of systems	Capacity (Watt)
1997			2003		
1998			2004		
1999			2005		
2000			2006		
2001			2007		
2002			2008		
			2009		

xi. Institutional Arrangement and Human Resources

Year	No of technical staffs	No of non technical administrative staffs	Labor	Total	Remarks
1997					
1998					
1999					
2000					
2001					
2002					
2003					
2004					
2005					
2006					
2007					
2008					
2009					

xii. Profit margin per system/project

……

……

xiii. Investment of company in this sector for commercialization of technologies

……

……

xiv. Market in absence of subsidy

……

……

xv. Support expected from government

……

……

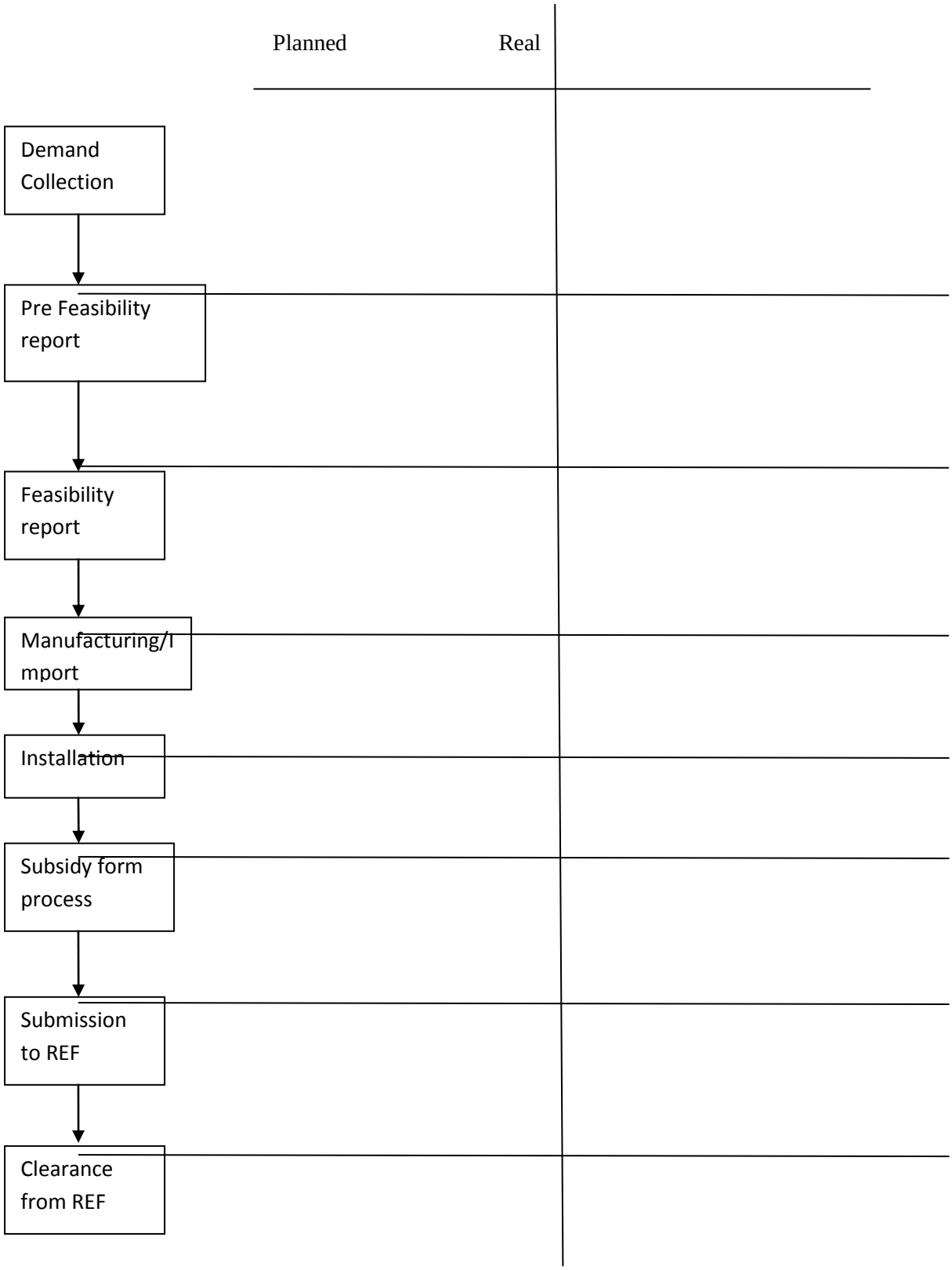
……

……

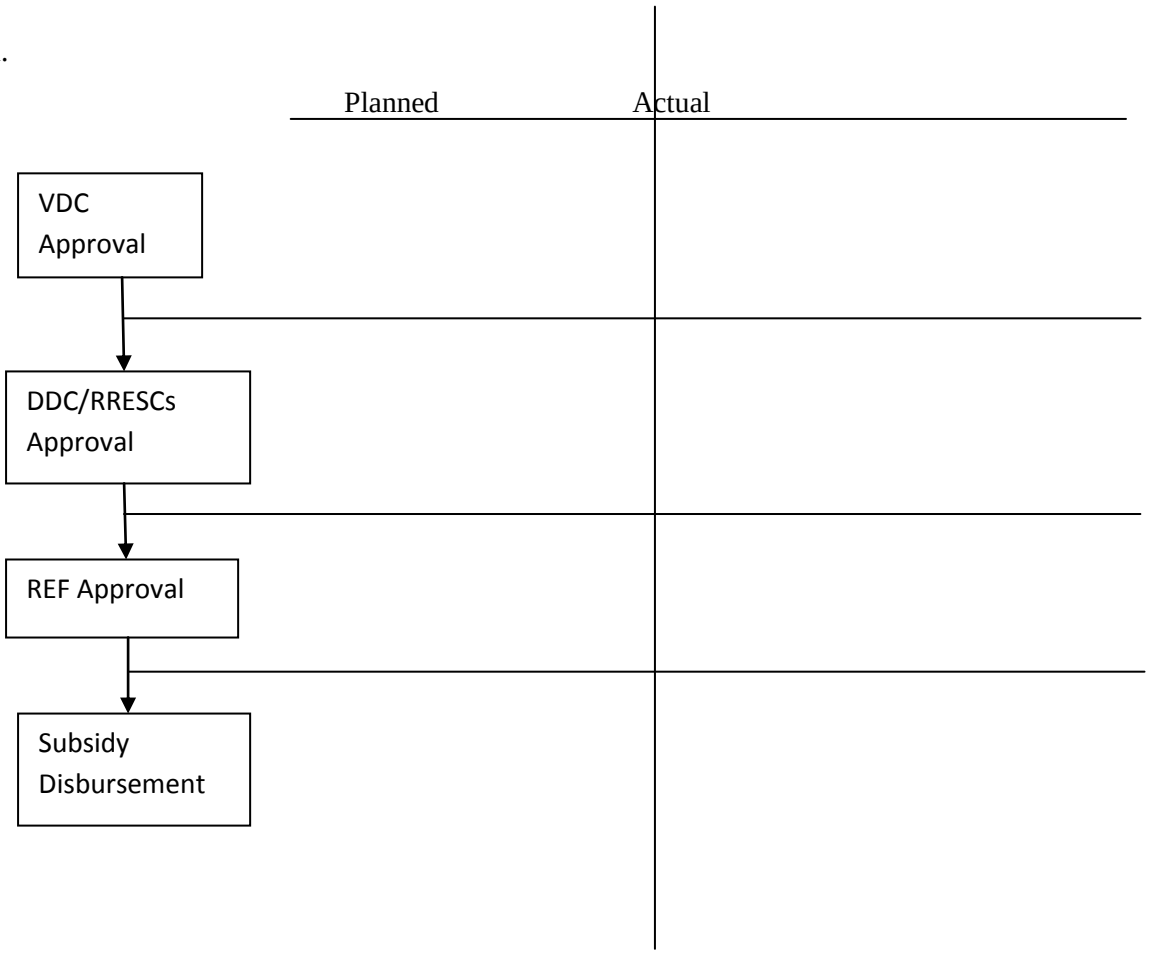
xvi. System Manufacturing/Selling

Components	Remarks	Local Manufactured/Imported
SOLAR		
Solar PV		
Battery		
Charge Controller		
Inverter		
Cables		
Lights		
Others		
MICRO HYDRO		
Turbines		
Pipes		
Generators		
Others		
BIOMASS		
Stoves		
Raw materials		

xvii. Time flow chart for Subsidy channelizing process (in days)



xviii.


Planned
Actual
VDC Approval
DDC/RRESCs Approval
REF Approval
Subsidy Disbursement

xix. Manufactures any comments (in relation to current subsidy delivery mechanism and possible improvements)

……
……
……
……
……
……
………………
……
……
……
……
……
……
………………
……
……
……
……
……
……
………………
……
……
……
……
……
……
………………

MANAGEMENT STAFFS (including POLICY MAKERS)

This includes management level staffs including policy makers at Ministry.

iii. SWOT(Strength, Weakness, Opportunities and Threat) Analysis of the program in relation to increasing:

- Affordability
- Accessibility
- Employment (Institutional/Commercial Capacity)

iv. RETs Market in absence of subsidized program\

It should see the policy in relation to

- Ease to administer
- Ease to implement
- Fairness and efficient

II. Subsidy on Micro Hydropower

(Amount in NPR)

Capacity	2000	2006	2009
Category A (up to 3 kW in 2000 and up to 5 kW in 2006 & 2009)	55,000 NPR/kW	8,000 NPR/HH but not exceeding 65,000 NPR/kW	12,000 NPR/HH not more than 97,500 NPR/kW generated
Category B (3 to 100 kW in 2000 and 5 to 500 kW in 2006 & 2009)	70,000 NPR/kW	Up to 10,000 NPR/HH but not exceeding 85,000 NPR/kW	15,000 NPR/HH not more than NPR 125,000 NPR/kW
Add-on MHP up to 5 kW (IWM)	27,000 NPR/kW	Up to 4,000 NPR/HH but not exceeding 40,000 NPR/kW	6,000 NPR/HH not more than 60,000 NPR/kW
Rehabilitation of MHP more than 5 kW	50% of the cost not exceeding NPR 35,000	Up to NPR 10,000 per incremental HH but not exceeding 85,000 NPR/kW	50% of installation cost not more than 62, 500 NPR/kW
MHP for institutional and community use			97,500 NPR/kW Plant up to 5 kW
Additional subsidy for transportation of equipment and material of the MHP project	NPR 21,000 (distance of more than 5 days) NPR 8,750 (Distance of 2 days to 5 days)	1,200 NPR/HH (25-50 km from nearest road head)	500 NPR/km/kW not exceeding 30,000 NPR/kW**
Additional subsidy for transportation of equipment and material of the MHP project in Humla, Jumla, Kalikot, Dolpa, Mugu, Rolpa, Rukum, Jajarkot, Bajhang, Bajura, Achham, Dailekh, Darchula		3,000 NPR/HH (More than 50 km walking distance from nearest road head)	30,000 NPR/kW
Additional financial support for productive use of energy			10,000 NPR/kW but not exceeding NPR 250,000 per project

** For all the projects getting transportation subsidy, the subsidy amount will be calculated as 1 kW per 8 households maximum

Source: Subsidy Policy for Renewable (Rural) Energy 2000, 2006 and 2009.

(ESAP 2011)

III. Subsidy for Solar Technology

(Amount in NPR)

S. N.	Type	2000			2006			2009		
1	Solar Home System	10 Wp	20 Wp	>30 Wp	10-18 Wp	More than 18 Wp	5 Wp WLED Based	10-18 Wp	More than 18 Wp	5 Wp WLED Based
	Category A	Additional 150% of category C subsidy			7,000	10,000	50% subsidy but not exceeding NPR 1250	7,000	10,000	2,000
	Category B	Additional 125% of category C subsidy			6,000	8,000		6,000	8,000	
	Category C	50% of the cost not exceeding NPR 8,000*		8,000	5,000	6,000		5,000	6,000	
	Category Description									
	Category A	VDCs categories as Category A by Ministry of Local Development (GON) in Nepal Gazette			Karnali and adjoining districts (Humla, Jumla, Kalikot, Dolpa, Mugu, Rolpa, Rukum, Jajarkot, Bajhang, Bajura, Achham, Dailekh, Darchula) and VDCs categories as Category A by Ministry of Local Development GON in Nepal Gazette			Karnali and adjoining districts (Humla, Jumla, Kalikot, Dolpa, Mugu, Rolpa, Rukum, Jajarkot, Bajhang, Bajura, Achham, Dailekh, Darchula) and VDCs categories as Category A by Ministry of Local Development GON in Nepal Gazette		
	Category B	VDCs categories as Category B by Ministry of Local Development (GON) in Nepal Gazette			VDCs categories as Category B by Ministry of Local Development (GON) in Nepal Gazette			VDCs categories as Category B by Ministry of Local Development (GON) in Nepal Gazette		
	Category C	Remaining Districts			Accessible VDCs			Accessible VDCs		

* The subsidy amount will be reduced every year by 10% for >30 Wp of category C and it was done till 2005.

Source: Subsidy Policy for Renewable (Rural) Energy 2000, 2006 and 2009, GoN

(ESAP 2011)

Subsidy for Solar Technology (contd..)

S. N.	Type	2000	2006	2009
2	Institutional Solar PV System			
	Subsidy for public institution		75% of the cost	75% of the cost
	Subsidy for lighting of public places			75% of the cost not exceeding NPR 15,000
3	Solar Water Pump			
	Subsidy for solar PV	75% of the cost up to 500 Wp	75% of the cost up to 1000 Wp	75% of the cost not exceeding NPR 1,000,000
4	Solar Cooker			
	Subsidy for solar Cooker	50% of the cost but not exceeding NPR 3,750 per Cooker	50% of the cost but not exceeding NPR 4,000 per Cooker	50% of the cost not exceeding NPR 5,000,000
5	Solar Dryer			
	Subsidy for household use	50% of the cost	50% of the cost but not exceeding NPR 20,000 per Cooker	50% of the cost up to NPR 20,000
	Subsidy for commercial purpose	70% of the cost	70% of the cost	70% of the total cost

* The subsidy amount will be reduced every year by 10% for >30 Wp of category C and it was done till 2005.

Source: Subsidy Policy for Renewable (Rural) Energy 2000, 2006 and 2009, GoN

(ESAP 2011)

IV. Subsidy for Improved Cooking Stoves

(Amount in NPR)

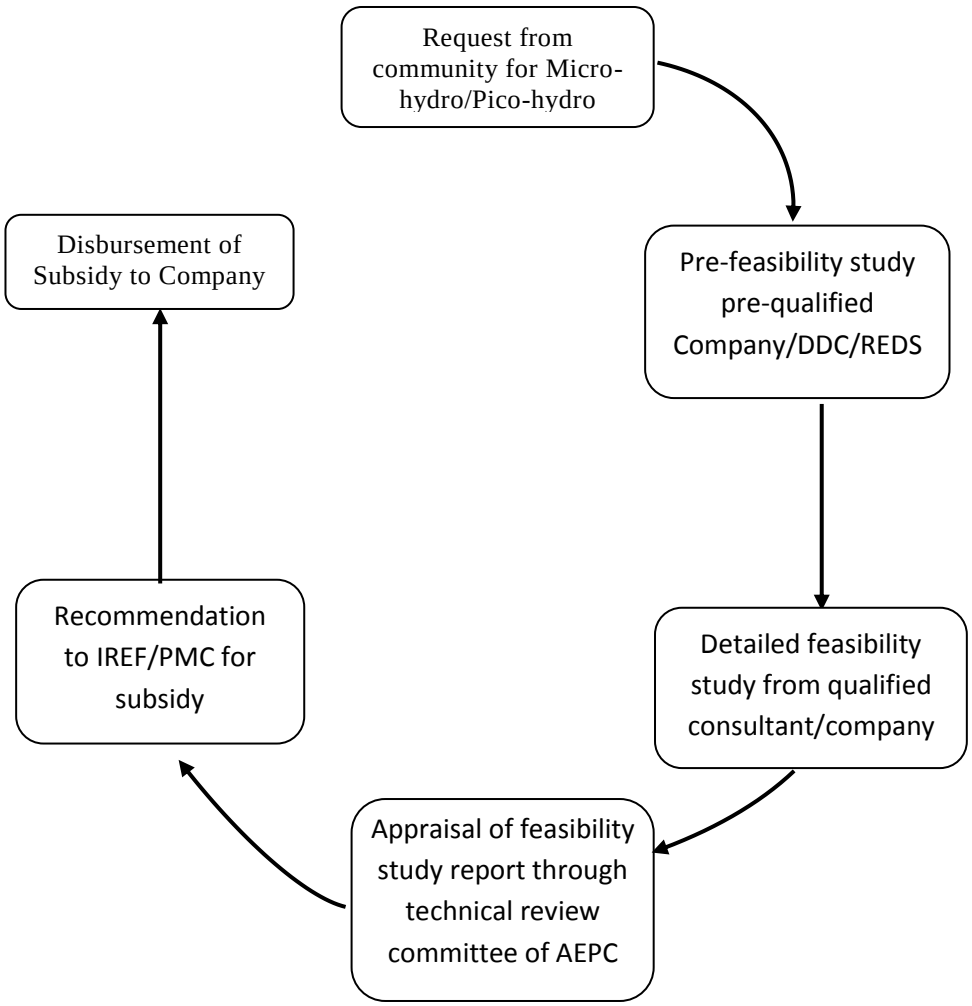
2000	2006	2009			
	Cooking and space heating	2 pot hole metallic stoves	3 pot hole metallic stoves	Subsidy for household	Subsidy for gasifiers
No Direct Subsidy has been provided to ICS	50% subsidy in High Mountains for cooking and space heating not exceeding NPR 2500	2,700	4,000	NPR 2,000 but not exceeding 50% of the cost	NPR 5,000 but not exceeding 50% of the cost

Note: the stoves should meet the standards defined by AEPC.

Source: Subsidy Policy for Renewable (Rural) Energy 2000, 2006 and 2009, GON

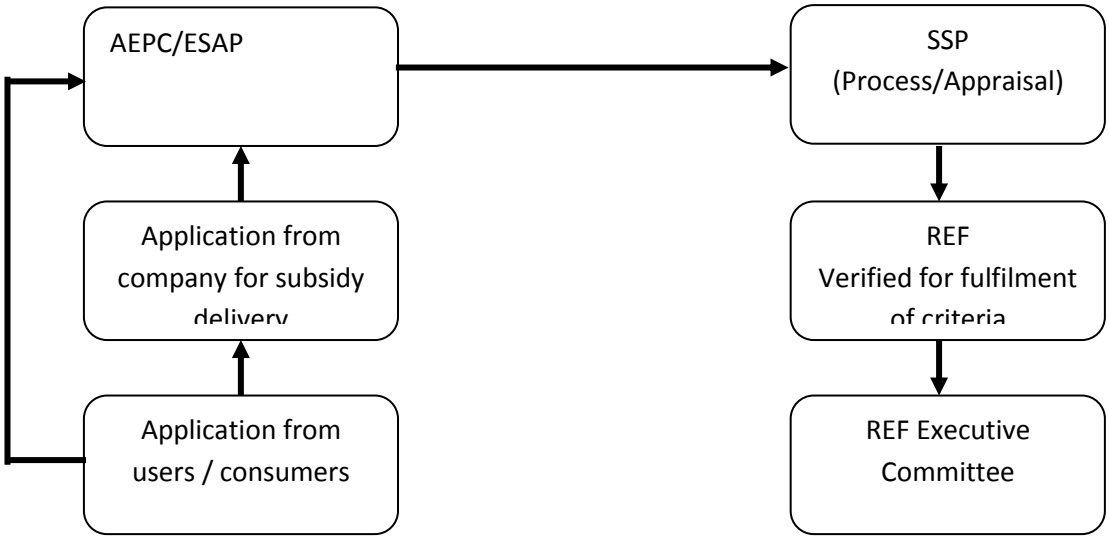
(ESAP 2011)

V. Subsidy Delivery Mechanism for Micro Hydro



(ESAP 2011)

VI. Subsidy Delivery Mechanism for Solar Home System



(ESAP 2011)

VII. Administrative Map of Nepal

Figure 23: Administrative Map of Nepal

Source: (UNHCR 2001)